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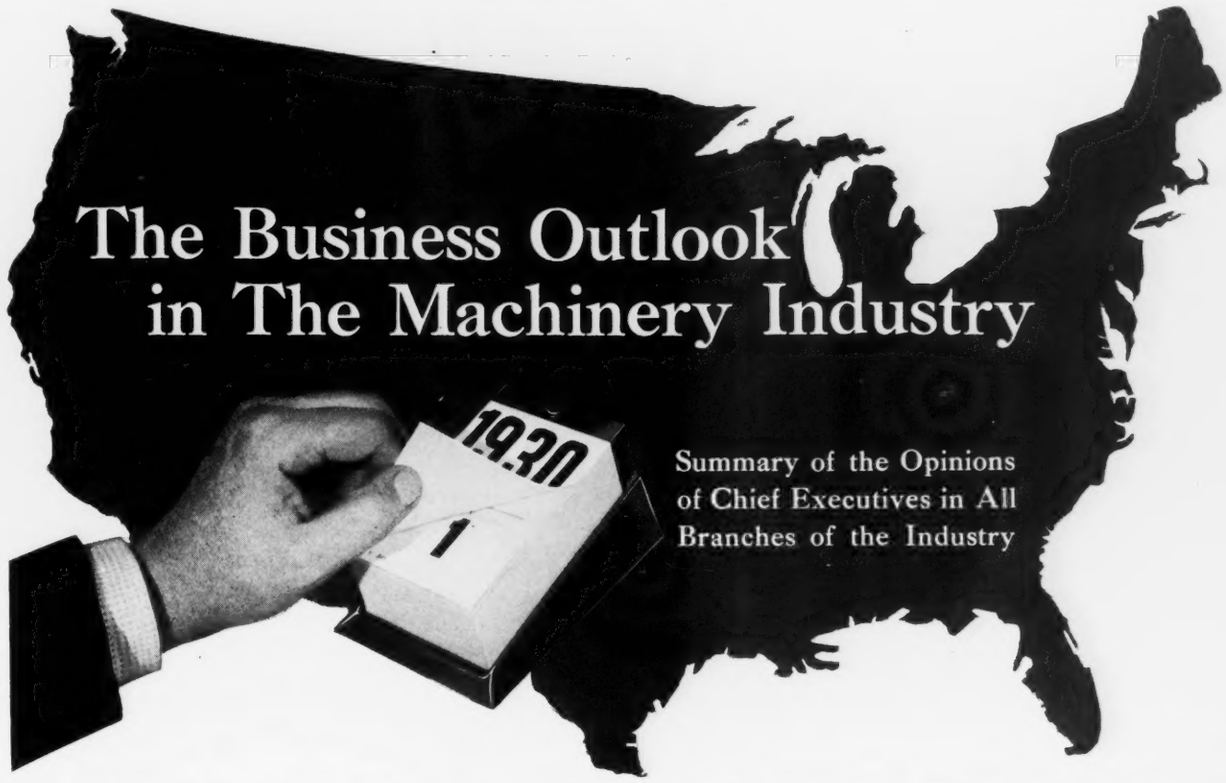


The Business Outlook in The Machinery Industry

Summary of the Opinions of Chief Executives in All Branches of the Industry

At the beginning of 1930 more than usual interest attaches to business forecasts. The developments in the stock market a few weeks ago caused business men in general to pause and question what effect the long-expected deflation in stock values would have upon industrial activity. By this time that question has been answered. The effect has been almost negligible in most industrial fields. Business and industry have continued on an even keel. The remarkable balance between production and consumption that has characterized the last few years has not been disturbed. Business and industrial leaders are in general agreement that the prospects for 1930 appear bright and that there is every reason for continued confidence in business stability.

President Hoover's conferences with business leaders in every branch of industrial activity bear out this conclusion. The railroads, public utilities, and many of the large corporations in the general manufacturing field are planning great expenditures for improvements and expansion. The value of the confidence created by the President's conferences cannot be overestimated.

Summary of MACHINERY'S Survey

If a summary is made of the reports reviewed in the present article relating to different branches of the machine-building and metal-working industry, it will be found that the prediction of a year ago for a steady improvement in business in 1929 has proved to be correct. The business in 1929 averaged from 15 to 25 per cent above that of 1928. The prospects for 1930 are for a healthy business, with a total volume about equal to that of 1928, which was a very good business year. Every year cannot be a record-breaker like 1929, but in many branches of the industry 1928 broke the records up to that time; and if the 1930 volume equals that of 1928, as indications are that it will, there is every reason for confidence in the future.

The Facts Concerning the Automobile Industry

Many have regarded the falling off in production of automobiles during November and December as an indication of a possible slump in that industry, and much has been said about the effect of the curtailment in the automotive field on other industries. However, a great deal of what has been said has not been founded on a very definite analysis of the conditions involved. The total output of automobiles in the United States and Canada in 1929 was approximately 5,500,000 cars and trucks. This is 20 per cent greater than the previous high record.

Compared with the unparalleled output during the earlier months of the year, there was a marked curtailment of production in the later months, but this was in no way caused by any unexpected developments either in the financial or the business world; it is accounted for by the seasonal decline which

always takes place toward the end of the year. If it was more noticeable this year than usual, it was because the output during the earlier months had reached such record-breaking figures.

A well-known automobile manufacturer once said, "After twenty years of contact with this business, I have become impressed by the fact that almost everybody outside of the field is inclined to think superficially about the automobile industry and indulge in forebodings regarding its future at a certain period each year. These forebodings become articulate about the fifteenth of November and continue to be impressive until the New York Automobile Show." This has been especially true this year, with about as much or as little ground for apprehension as in years past.

Leading men in the automobile field do not by any means expect that the output in 1930 will be as large as in 1929 because that was a record-breaking year. They do expect, however—and their expectations are backed up by ample evidence in the present business situation—that the output of the automobile industry in 1930 will be somewhere between 4,500,000 and 5,000,000 cars—a production that will be greater than that of any previous year with the exception of the one just ended. The inserts on this page and that opposite give the views of Alvan Macauley, president of the National Automobile Chamber of Commerce and president of the Packard Motor Car Co., on this subject.

The Value of Business Forecasts

It is almost too obvious to need repetition to say that a business, to be successfully managed, must be carefully planned, and that planning, again, presupposes an estimate of the future—that is, a forecast. Some kind of opinion as to the coming year must be formed by every successful executive, and in forming an estimate of the business to be expected and making plans for the future, a most reliable guide is furnished by the opinions of industrial leaders in different branches of the industry.

These leading executives base their own plans upon their estimate of the business prospects for the coming year, and their opinions, therefore, should furnish a valuable guide to others in the industrial field. The larger the number of opinions, the more accurate are the conclusions based upon them likely to be; and a summary of the views of a great number of industrial executives is quite certain to present a fairly accurate indication of business conditions during the coming year.

MACHINERY has, therefore, as in previous years, asked more than 1400 executives in every branch of the machine-building and metal-working industries for their views on the 1930 business prospects. It is possible, from the replies received, to obtain a consensus of opinion that should be of value to every executive responsible for the management of an industrial enterprise. The results of this inquiry, as published in the following pages, cover a broad field including more than fifty distinct metal-working industries.

The Output of the Machinery Industries is One-fifth of Our Manufactured Products

The importance of the machine-building and metal-working industries might well be emphasized in this connection, because their prosperity to a large extent determines the prosperity of other industries throughout the nation. If we group together the shops that produce machinery of all kinds; those that make transportation equipment, in the building, repairing, and maintenance of which machine tools are used (without, however, including the garages and automobile service stations); and those that produce metal articles and parts, we find that approximately 20,000 shops are engaged in these branches of industry. These shops employ over 1,800,000 wage earners, and the total value of the products is approximately $12,000,000,000.

The total value of the products of the manufacturing establishments of this country aggregates about $63,000,000,000. The machine shop field is responsible for approximately 20 per cent of the total industrial output in the United States. Through its 1,800,000 workers, this industry supports directly a population of approximately 10,000,000 people.

Agricultural Machinery and Implements

There is a gradual improvement in conditions in the agricultural field, and this improvement will inevitably result in improved business in the agricultural machinery and implement industry. This business was, on an average, about 15 per cent greater in 1929 than in 1928, and several of the leading manufacturers believe that business in 1930 will be still better than in 1929. There is a tendency in this field toward the acquisition, on the part of the larger agricultural machinery and implement manufacturers, of complete lines of everything needed in farm operation, and this obviously creates a keen competitive condition in the industry.

President of the Automobile Chamber of Commerce Reviews Status of Industry

Alvan Macauley, President of the National Automobile Chamber of Commerce and President of the Packard Motor Car Co., states that in 1928, the value of cars and trucks manufactured was $3,163,000,000, and the exports of vehicles, parts, and tires exceeded $578,000,000. The figures for 1929 will be even greater. For the first time since the Civil War, cotton takes second place as the most valuable of our exports, the latest figures showing that American motor products exported exceeded in value that of any other item. The automobile industry is in a most wholesome and healthful condition. One of the largest companies reports business as just 7 per cent below normal for this season of the year. Inventories are not excessive, thanks to the system of short-time inventory control which is general throughout the industry. Wages are at a high level. The automobile industry has been a leader in maintaining wages, and it has been able to do so through the perfection of its manufacturing equipment.

The farm tractor industry has had a satisfactory year, and is looking forward to a slight increase in business in 1930—possibly 5 per cent greater than in 1929.

The Automotive Industry Looks Forward to a Good Year

The general prospects of the automobile industry have already been referred to in the introduction to this article. The expectation that 1930 will be as good a year in this field as 1928, which up to that time was the record year, is based upon sound reasoning. While the domestic passenger car business is not expected to be quite so large as during the year just ended, the exports of passenger cars have been steadily mounting for several years, and there is every indication that 1930 will see an exceptionally large export business in this line.

The bus business last year was approximately 20 per cent greater than in 1928, and another 10 per cent increase is expected during the coming year. Commercial trucks have also been unusually active during the past year and a still further increase is expected in this branch of the industry. The automotive parts industry obviously, depends directly upon the output of passenger cars, buses, and trucks, and in view of the foregoing, parts manufacturers have every reason to look forward to a good year, even if not a record-breaking one like 1929.

The Ball Bearing Industry

As so large a percentage of the production of the ball bearing industry is directly absorbed by the automotive field, it is expected that the production of ball bearings during 1930 will follow closely that of automobiles. During the past year, it has been about 20 per cent greater than in 1928, corresponding almost exactly to the increase in the output of passenger cars and trucks. It is expected that the output in 1930 will be about the same as in 1928, or may possibly show an increase of a few per cent.

Brass Goods Manufacture Depends Upon Building Activity

The brass goods industry depends to a very large extent upon the building industry. The efforts made by President Hoover to stimulate the building industry and to accelerate municipal, state, and federal construction will have a decided influence in this field. The credit situation is also much better for the building industry than it has been during the past year. These factors are likely to have an important bearing on the prospects in the brass goods field. Some representative firms report an increase in 1929 over 1928, while one large concern reports a decrease. The prospects are that 1930 will about equal 1928 in output.

Cash Registers, Typewriters, Adding and Computing Machines

A summary of the reports received from manufacturers making cash registers, fare recording devices, adding and computing machines, and typewriters, show that 1929 business exceeded that of 1928 by about 10 per cent, and another 10 per cent increase is looked forward to in 1930. It is believed that, while business has slowed up somewhat toward the end of the year and while the first few months of the new year will show a somewhat reduced activity as compared with the corresponding months in 1929, the latter part of 1930 will again be a period of great activity.

Castings and Forgings Follow the Trend of Industry in General

It is evident that the foundry and forge shop industries would show an increase in business corresponding to the general increase in the metal-working industries during 1929. Representative firms report a business averaging 20 per cent greater than in 1928; they expect that 1930 will be a year not quite so good as 1929, but quite equal to 1928, which is considered a normal year. In fact, in some instances, a volume corresponding to that of 1929 is expected in the forging field because of the increased activity expected toward the latter part of the year.

Chemical Machinery and Equipment—Cotton Ginning Machinery

Reports from leading manufacturers of chemical machinery and equipment indicate that the output in this line was about 15 per cent greater in 1929 than in 1928. It is expected that the coming year will at least equal the business of 1928. The constant growth of the chemical industries in this country makes a fair business quite certain.

The volume of business in cotton ginning machinery for 1929 was approximately 10 per cent greater than that of 1928. The prospects are that the business in 1930 will be about equal to that of 1928, possibly showing a slight increase. The cotton crop conditions are such as to warrant optimism in regard to next year's business in cotton ginning machinery.

Why the Automobile Industry Expects a Good Year in 1930

There are 25,000,000 motor vehicles in use in the United States, and the demand for replacement is now 2,750,000 cars per year. It is estimated that in a normal year the industry should produce 5,000,000 motor vehicles. The replacement demand, therefore, gives automatically 55 per cent of a normal year's business. The export trade, unaffected by stock market conditions, during the past year was approximately 1,000,000 vehicles, which is 200,000 more than the year before. It seems conservative, therefore, to expect an export business of upward of 1,000,000 cars in 1930, which is 20 per cent of a normal year's production. Export added to replacement expectation gives a business of 3,750,000 cars and trucks, which is 75 per cent of a normal year's business. To this must be added new buyers, two-car families, and a rapidly increasing truck and bus business, which should bring the total to 5,000,000. The country at large has no cause to worry about the motor vehicle industry.

Crane and Hoist Manufacturers Expect a Growing Demand

The crane industry experienced the same general improvement as other industries during the past year. The average of several leading firms in this field indicates an increase in business of about 15 per cent over that of 1928. Most manufacturers expect approximately the same business in 1930 as they have had during the past year, but two well-known makers are looking for a substantial increase—from 10 to 20 per cent over 1929. There is an increasing tendency toward the use of efficient material-handling equipment, and this should augment the demand in this field during the coming year to a considerable extent.

The Cutlery Industry Expects a Normal Business

There is no great change in the output of the cutlery industry from year to year. The business in 1929 was approximately the same as in 1928—possibly slightly better—and on the whole, the same business is expected in 1930. This industry is not affected to any great extent by minor changes in general business conditions. It is more directly dependent upon crop conditions and the tariff situation. The business in silverware has remained approximately the same during the last four years, with a slight upward trend in 1929, and there is a favorable outlook for at least an equal volume of business in 1930.

The Electrical Machinery and Tool Industries

As is well known, the electrical industries have had a very active year in 1929. The volume of business done by several of the electrical companies has been from 10 to 20 per cent greater than in 1928. The increasing demand from public utility corporations promises an active business in power plant equipment during the coming year, and while it is difficult to estimate exactly how large the prospective business may be, 1930 is looked forward to with great confidence. Makers of electric welding equipment have increased their business considerably during the past year; new uses are constantly being found for the electric welding process. The demand for electric equipment of all kinds has been growing rapidly, and in every instance, is expected at least to equal the very active business of 1928.

Portable electric tools have been in active demand, their value being more and more recognized in all metal-working industries. One firm reports an increase of 30 per cent over 1928 and, allowing for a slight slowing up of business in 1930, still expects to do a business in portable electric tools that will be at least 20 per cent greater than that which this firm did in 1928.

Good Business Expected in Elevating and Conveying Equipment

The increasing interest shown by industrial executives in material-handling equipment has caused a great improvement in this line of business during 1929, several leading firms reporting anywhere from 12 to 40 per cent increase over 1928. Owing to the cautious attitude on the part of business executives in general, some of the manufacturers in this field do not expect quite the same volume of business in 1930, but they still anticipate an increase over 1928, the average increase being estimated at about 10 per cent. More and more time is being spent by engineers and executives on the problem of reducing costs by introducing labor-saving equipment, and this will have a favorable effect on the sales of material-handling equipment of every description.

Excavating and Road-building Machinery Promises to be Active

The volume of business in excavating and road-building machinery, according to several large producers, was from 10 to 25 per cent greater in 1929 than in 1928. One of the leaders in this field looks forward to a still larger business in 1930 because of the increased activity in road-building and construction of public works. The deflation of the stock market will doubtless result in cheaper money rates, so that bonds for public work improvements can be readily sold. President Hoover's recent conferences will also give an impetus in this direction. The foreign trade has been unusually encouraging during the past year.

Opinions Vary in the Fan and Blower Industry

Excluding small electric fans, the business in fans and blowers in 1929, as reported by several leading manufacturers in this field, has averaged about 12 per cent above the business in 1928. Opinions vary as to the prospects for the coming year, one well-known manufacturer looking forward to a decrease in business, while another prominent maker looks forward to a slight increase—about 5 per cent or so. The increase would be accounted for by the fact that public utility corporations have been somewhat curtailing their purchases during the past year, and are likely to buy a considerable amount of new equipment in 1930. There is also a constantly broadening market for ventilating equipment, which will tend to increase the volume of business. Furthermore, the capital released for new construction will be of material aid to this branch of the industry.

A Good Year in Gears and Speed Reducers

The business of gear manufacturers, particularly those who specialize on speed reducers, was unusually good during 1929. The average increase in volume was 30 per cent, and, in view of the increasing application of speed reducers in so many industrial fields, the prospects are for a slight increase in 1930, not perhaps so much as 10 per cent, but not very far from it. The demand for industrial gears in general has been good, as would follow from the general industrial activity during the year. This demand may fall off somewhat during the early part of 1930 on account of slight curtailment of industrial expansion, but is likely to resume its usual volume later in the year.

Grinding and Pulverizing Machinery

The reports from manufacturers making grinding, crushing, and pulverizing equipment indicate an average increase of about 6 per cent in the business of 1929 over the previous year. One leading manufacturer anticipates a considerably increased business in 1930, but this may be due to conditions affecting this company alone. This is a branch of the industry in which it is somewhat difficult to estimate future demand, as it caters to a great diversity of industrial fields, some of which may experience considerable prosperity in 1930, while others will be more quiet and hence cautious in the installation of new equipment.

The Hardware Industry Expects a Year Like 1928

In the hardware field, reports vary considerably. Some concerns did not exceed their 1928 business materially during the past year; others, again, report as much as a 30 per cent increase. The general opinion is that 1930 will be approximately the same kind of year in this industry as 1928, or possibly a little better. Much depends upon the building industry, farm conditions, and general business activities as a whole.

Hydraulic Presses and Equipment

A leading hydraulic press manufacturer reports a 5 per cent greater volume of business in 1929 as compared with 1928. Another manufacturer of hydraulic machinery reports a 20 per cent increase. These manufacturers expect to maintain in 1930 the volume of business that they had in 1929, and in one instance, due to the introduction of outstanding new developments in hydraulic equipment, an increased volume of business is expected. "All indications are that 1930 will be a good year in the machinery field," says this manufacturer.

Industrial Furnaces Are Being Installed to an Ever Increasing Extent

The demand for industrial furnaces is constantly increasing on account of the many operations for which such furnaces are used, not only in the heat-treatment of metals, but in a variety of industries. A leading maker in this field reports a 30 per cent greater business in 1929 than in 1928, and indications are that the business in 1930 will be 20 per cent greater than in 1929.

The Laundry and Washing Machinery Branch is Optimistic

In the laundry machinery industry, an average increase of about 5 per cent over the business in 1928 is reported. It is expected that there will be no material change in demand in 1930—in other words, the volume of business during the coming year is expected to be about the same as during the year just ended. In the domestic washing machine field, a greater improvement in business is expected. One well-known manufacturer reports a 15 per cent increase in 1929 over 1928 and expects an additional 30 per cent increase next year. There has been a marked tendency in the washing machine field toward a larger volume of sales at lower unit prices. This will have a decided influence on the output in 1930.

Locomotives and Railroad Cars

The great improvements that have been made in locomotive design to increase efficiency in railroad operation justify the scrapping of comparatively new engines and their replacement by modern locomotives. When the locomotives of today are placed in operation, adequate returns on the investment are immediately apparent and are so satisfactory as to justify the replacement of engines that are otherwise good but not nearly so efficient in power generation. Nevertheless, the railroads hesitate somewhat to replace locomotives that only a few years ago were considered modern. On the whole, however, the situation in the locomotive-building industry is fairly satisfactory.

The volume of business was approximately 30 per cent greater in 1929 than in the previous year, and the prospects are that the volume of business in 1930 will be about the same as in 1929. This refers especially to railroad steam locomotives. In the industrial locomotive field, the increase in the volume of business has been even greater, with even more satisfactory prospects for 1930. One manufacturer reports that to take care of the growing business, an increase in plant capacity of about 15 per cent will be required.

The business in railroad car building also promises to be quite active. The volume in 1929 was greater than in the previous year and one leading builder, at least, expects a considerably increased business in 1930.

The Machine Tool Industry Has Had a Year of Great Activity

It seems to be the general opinion that 1929 was the most prosperous year that the machine tool industry has ever experienced; it certainly was a year of healthier prosperity than ever before. The volume of business was approximately 25 per cent greater than in 1928, which latter year, according to Ernest F. Du Brul, general manager of the National Machine Tool Builders' Association, can be considered a normal year.

The high point in orders was reached in May, from which time there has been a gradual decline which may last until, say, about next March, at which time it is reasonable to assume that there will be another upward trend. The volume of business during the coming year will depend directly upon the activity in other machine-building and metal-working industries, but judging by the expectations for business in these other fields, 1930 should not fall below 1928.

Progressive machine tool builders are now busy studying their own production methods; they have installed a great many new machine tools during the last few years with a view to reducing their own costs. In this way, they will also be ready to take full advantage of the next cycle of demand which is likely to set in only a few months hence.

Metal-cutting Tools and Tooling Equipment

As might be expected, the sales of metal-cutting tools during 1929 have run ahead of 1928 in about the same ratio as the sales of machine tools. Manufacturers of taps, dies, drills, and milling cutters report an average increase of from 20 to 25 per cent in their business as compared with 1928. As to the prospects for 1930, opinions are somewhat divided, but it may be said that the industry is planning, on an average, for an output approximately the same as in 1928, with possibly a slight increase over that volume in some lines.

In the special tool and tooling equipment field, 1929 has been an unusually active year. Practically everyone engaged in this line of business reports from 20 to 80 per cent greater business than in the previous year; and while a falling off is expected in 1930, almost all the shops engaged in this line of business expect to do better than in 1928, which should result in very favorable conditions in this branch of the industry.

The Mining Machinery Manufacturers Expect No Reduction in Business

In the mining machinery field, there has been a constant improvement for several years. New equipment has been introduced both in the coal- and metal-mining branches. The volume of business in 1929 as compared with 1928 was from 12 to 20 per cent greater. Some of the largest manufacturers in this field expect continued improvement, although, as the year just ended has been such a banner year in most branches, it is not expected that 1930 will far exceed it; but it is generally believed that it will about equal it.

The Demand for Oil Field Equipment is Less Active

In the oil field equipment branch, business has not been proportionately so active as in most other branches of the machine-building and metal-working industries. Production of crude oil has continued in excess of demand. At present there seems to be a great effort on the part of California and mid-continent producers to curtail operations. This plan will ultimately produce good results. The business in 1929, on an average, has only been about 5 per cent greater than in 1928, and according to conservative estimates, the 1930 business will not be quite so large, because the overproduction already mentioned is likely to hold back buying of equipment in the early months of the coming year. On the other hand, there is a possibility that some of the older oil fields will be pressed into production again, and if this should take place on a large scale, there would be an increased demand for certain types of oil field equipment.

Paper and Pulp Mill Machinery

From the available sources of information, it appears that the volume of business in 1929 has been about 20 per cent greater than in 1928, but it is not expected that there will be quite so large a volume in 1930. It is believed, however, by one of the leading makers in this field, that 1930 will equal 1928. The delay of Congress in passing the Tariff Bill is stated to have affected this industry adversely. On the other hand, President Hoover's attitude toward business and his active cooperation in placing business on a firm basis will aid this as well as all other industries.

The Demand for Power Plant Equipment is Expected to be Very Satisfactory

The power plant equipment field is so broad and the products manufactured for power plants so diversified that it is somewhat difficult to arrive at an average figure that would be representative of all branches. It may be stated, however, that all the firms in this field that have reported on present and prospective business have experienced at least as good a year in 1929 as in 1928, and in the case of the larger companies, a much bigger business; the figures reported vary from 5 to 25 per cent.

In this field, most firms expect that 1930 will be at least as good as 1929, and some predict a considerable increase because of the activity of the public utilities corporations. There is a decided trend toward higher steam pressures, larger steam generating units, and higher rates of evaporation.

Power Transmission Equipment

It is evident that the power transmission industry would reflect quite closely the general industrial activity; hence, we find that in this field business in 1929 has been, on an average, about 25 per cent ahead of 1928. On account of the present attention to proper power transmission equipment, it is likely that this business will run somewhat ahead of general industrial activity in 1930 and that the volume during the coming year will equal that of the year just ended. The general tendency at the present time to consider carefully the cost of maintenance in power transmission equipment is likely to bring more modern equipment of this kind into use.

Printing Machinery Manufacturers See Active Business Ahead

Leading manufacturers of printing machinery have increased their business in 1929 over the previous year from 20 to 30 per cent. Indications point to continued good business in 1930, and while some manufacturers do not believe that it will quite equal the 1929 business, all reports indicate an increase of at least 15 per cent over 1928.

The Pump Manufacturing Industries

Pump manufacturers appear quite optimistic as regards the coming year. On an average, the business of the manufacturers whose reports are available indicate an increase in 1929 over 1928 of from 15 to 20 per cent. It is believed that the 1930 volume will at least equal that of 1929—in other words, the gain over 1928 will be maintained during the coming year.

There is a Constant Increase in the Output of Refrigerating Machinery

The tendency of ice manufacturers to sell out their business to public utility corporations has

somewhat changed the complexion of the refrigerating machinery business, but has not apparently altered its progress or development. One of the leading manufacturers in this field reports the same business in 1929 as in 1928 with but a slight excess; another reports a 12 per cent increase. Indications are that the 1930 business will equal that of 1929, hence, showing an increase over 1928.

Rolling Mill Machinery

Practically all the manufacturers of rolling mill equipment are unanimous in their statements that 1929, from the point of view of production, has been a big year. An average increase of 30 per cent over 1928 is reported. It is not expected by most manufacturers, however, that 1930 will give them as big a volume. It is anticipated, rather, that 1930 will equal 1928, or possibly show an increase of about 5 per cent. This conclusion is borne out by the general conditions in the steel industry, in which 1929 was a record-breaking year, hardly to be equalled by 1930. On the other hand, the tendency on the part of the steel mills to keep their equipment in up-to-date condition will react favorably on this branch of the machine-building field.

The Shoe Machinery Industry

Manufacturers in the shoe machinery industry state that business was close to 5 per cent greater in 1929 than in 1928, with the prospects that 1930 will be a still better year, the increase over 1929 being estimated at anywhere from 5 to 15 per cent. The modernizing of shoe factories is the main reason for this anticipated increase in business.

The Demand for Sugar Machinery Will be Less than in 1929

Two leading builders of sugar mill machinery report a considerable increase in business in 1929 over 1928. In one instance, this figure was about 15 per cent, and in the other, over 30 per cent. As to 1930, it is not expected that the demand will be so great. It is more likely to equal 1928. The tariff on Cuban sugar has a considerable influence on this branch of the industry. With an increased tariff on sugar, there will be a decided curtailing in the purchase of new sugar machinery for Cuba.

Telephone Apparatus and Equipment Shows Remarkable Upward Trend

In few industries has the volume of business in 1929 been as much in excess of the 1928 business as in the telephone apparatus field, reports varying all the way from 35 to 50 per cent. Indications are that not only will the 1929 volume be duplicated in 1930, but some manufacturers expect an increase in this particular field.

The Prospects in the Textile Machinery Industry

In the textile machinery field, the reports vary somewhat according to the line of equipment built. Machinery for cotton mills has not been as active as machinery for the manufacture of silk. One of the leading manufacturers in the former branch reports practically the same volume of business in 1929 as in 1928 and expects about the same volume of business in 1930, possibly a slight recession in the early part of the year. On the other hand, it is recognized that the fundamental conditions of business are sound and that as soon as the pessimism occasioned by the stock market break has spent itself, there will be more confidence in this branch of the industry. Changes in styles, now so prominent, are bound to affect the textile industry favorably; this, in turn, will react favorably upon the textile machinery field.

Some manufacturers building machinery for the silk industry mainly report increases in business in 1929 over 1928 of from 40 to 50 per cent. It is not generally expected that the business in 1930 will show any such volume as this. However, it is believed that it will not only equal 1928, but be at least 5 per cent greater. Changing styles in silk fabrics and in silk knit goods will continue to keep this branch of the industry active.

The Woodworking Machinery Industry

The woodworking machinery industry has experienced an activity similar to that of the other branches of the machine-building field. Increases in business over 1928 were reported by different firms as varying from 20 to 25 per cent. The manufacturers in this field, however, do not believe that they can maintain this volume of business during the coming year. Some expect a volume equal to 1928, while in one instance a decrease of about 10 per cent is anticipated, because of an expected shrinkage in automobile production. In view of the fact that the present indications point to an automobile output in 1930 equal to that in 1928, it is reasonable to expect that the woodworking machinery business may be better than anticipated, and that it will at least equal the 1928 volume. The great improvements that have been made in woodworking machinery during recent years will also aid in creating a market.

Great Savings by Plant Rearrangement

When a manufacturing plant grows rapidly, and additions must be made from time to time to meet emergencies, it is not always possible to arrange the machine equipment and the work-handling facilities as advantageously as if the entire plant had been originally planned with a knowledge of future requirements. However, sooner or later it will be found advantageous to rearrange the plant to obtain a higher degree of efficiency. Such a rearrangement has been made in one of the large automotive engine-building plants in Detroit. This has resulted in a great increase in the general efficiency. The savings made in transportation of work alone will amount, in one year, to more than the entire cost of the rearrangement. Furthermore, the changing over from the old arrangement to the new was done with practically no falling off in production. An article describing these remarkable achievements will be published in February MACHINERY.

Forging Wrenches for Airplane Engines

Producing Spark-plug Wrenches by Forging in a Drop-hammer Die and Finish-forming and Sizing in a Forging Machine

By CHARLES T. KETZ

AT first glance, the spark-plug wrench shown in Fig. 1 would appear to be a comparatively simple production forging job. However, a closer examination of the specifications and form of the wrench will reveal features that somewhat complicate the forging problems. The first method tried out, which consisted of forging the wrench to the finished form in a drop-hammer die, did not give an adequate production rate, and the cost of finishing the forging to the specified form was too high.

After making a thorough study of the work, the method to be described was developed. The forging of the wrench to the form shown in Fig. 2 is done in a drop-hammer die. After this operation, the wrench is formed to the shape shown in Fig. 1 by the die illustrated in Fig. 3. This die is used in an Acme forging machine of the 1-inch size. The offset in the handle of the wrench forging, as shown in Fig. 2, facilitates the final forming of the handle.

After being cold-trimmed, the forgings are reheated for forming in the die shown in Fig. 3. The forming equipment consists essentially of the die, which is composed of the two members *A* and *B*, the forming punches *C* and *D*, the punch-holder *H*, the gripping jaws *E*, and bridge *F*. The head of the heated forging is placed in the impression in the die, with the handle inserted in the gripping jaws *E*. Thus positioned, the forging is prepared for the final operation, which consists of bending the handle to the desired shape and finishing the opening that is to fit the spark plug. In the illustration, the forging is shown in the correct position for this operation.

In Fig. 3 the forming punch is shown in the

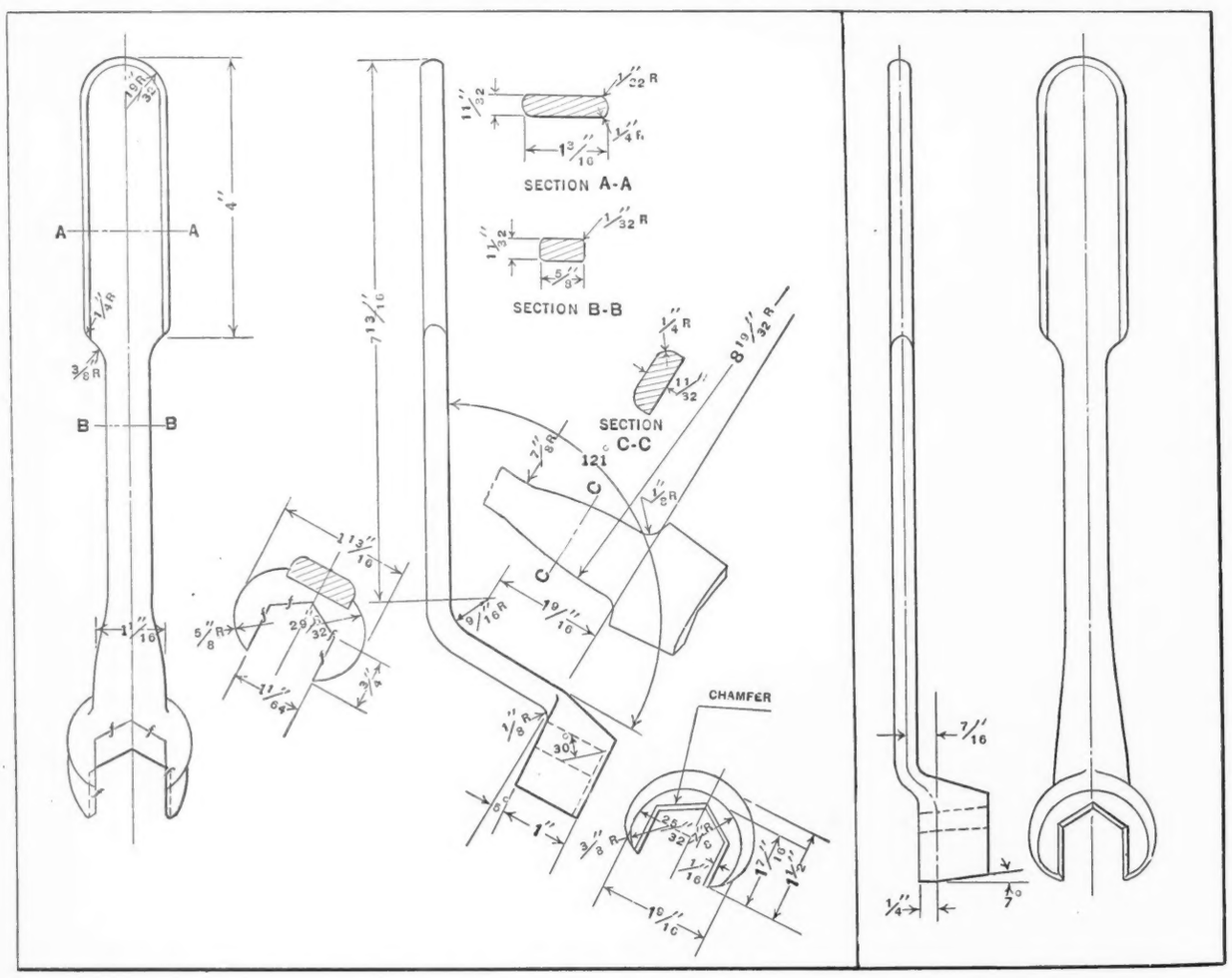


Fig. 1. Details of Spark-plug Wrench Produced in Two Operations. Fig. 2. Forging Produced in First Operation

position it occupies at the completion of the forming operation. In the latter position, the punch *C* has formed the handle of the wrench to shape by forcing it into the cavity formed by the two die members *A* and *B*. This illustration shows how the punch *D* finishes the opening of the wrench to the desired size. It will be noted that both punches are well supported before they come into actual contact with the work. The spring lip of the gripping jaws *E* opens in the direction of the punch travel and thus frees the forging for the bending operation.

The dies are made of tool steel and are hardened. The punch *C* is made of soft steel, with the working surfaces inlaid with hardened and ground tool-steel inserts. The punch *D*, which is subjected to severe usage, is made of special steel. The slot at *L* serves to prevent the punch from twisting in the holder. The set-screw *K*, which is set at an angle of 45 degrees with the body of the holder, serves to hold the punch *D* in place.

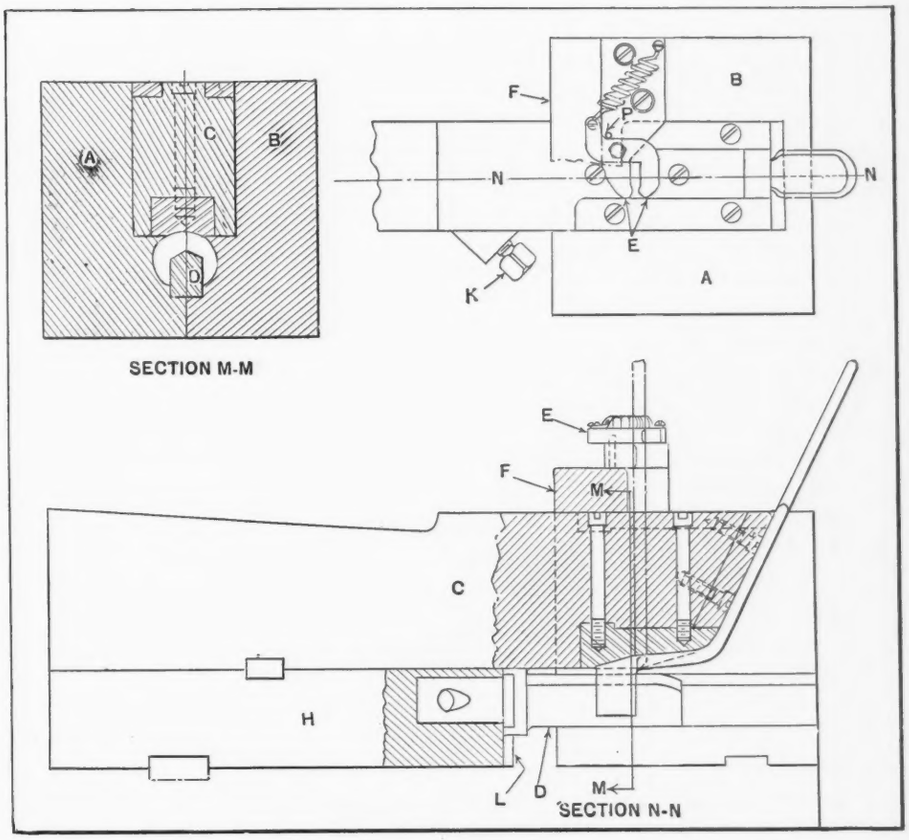


Fig. 3. Plan and Cross-section Views of Die Used to Finish-form and Size the Wrench Shown in Fig. 1

* * *

BUSINESS TRAINING FOR THE ENGINEER

In an address made by Charles Piez, president of the American Society of Mechanical Engineers, and Chairman of the Board of the Link-Belt Co., before the Akron Section of the society, the need for business training for engineers was emphasized. Mr. Piez stated that mechanical engineering represents the best means of acquiring a broad foundation for a useful, practical life—one that not only provides opportunities for a professional career, but also affords abundant chance for success in a business career.

"This," said Mr. Piez, "is true because engineering training develops the ability to dig up and weigh the facts properly before reaching a conclusion, and this ability is the basis of sound judgment in every walk of life. But why is it that, with this educational equipment, so relatively few engineers step from the engineering department into high sales, managerial, or executive positions?

"The engineer has been responsible for the remarkable improvement in the methods of production and for the reduction in costs; he has become an important factor in the development of industry; yet it is only in rare cases that he dominates it or determines its policies. With increased capacity for production, the problems of distribution and finance have become the dominant ones, and for these the engineer shows no particular leaning nor special aptitude."

"Nevertheless," Mr. Piez continued, "when you find a man who combines the personality of a bond salesman with the technical training of the engineer, you have a super-salesman, the salesman we are all looking for. In any group of engineers there is a goodly percentage content to practice their profession without suffering the tension and shouldering the responsibility which the quest for high sales or executive position involves. These engineers fill a very useful niche in industry, and it is upon them that most of the burden of design and development falls.

There is a smaller number, however, in whom the desire for greater compensation or higher position is ever present. It is the members of this group who show greater aptitude for acquiring the necessary experience to qualify them for advancement in the business departments. As a rule, recent graduates from technical schools are addicted too much to formulas and too little to observation. They are often deficient in power to express themselves simply and clearly, so that a layman can understand. They are lacking also in knowledge of the elements of cost keeping and show but little inclination to acquire it.

"Additions of a course in English, in economics, and a real course in cost-keeping to the curricula of the modern technical schools, would fill a decided gap in the training of engineering students, and would prepare them for more rapid advancement in the business field."

The Carry-Motion Press and its Work

Features of a Press Equipped with a Magazine Feed, Multiple Dies, and an Automatic Transfer Mechanism

By FRED R. DANIELS

THE carry-motion press is a wide-pattern double-crank type, fitted with a six-motion transfer or carry feed and multiple tools or dies. It may be of either the open-back or open-side pillar type. In Fig. 1 is shown an open-side pillar press equipped with a carry motion and multiple tools or dies. Presses of this type are suitable for the quantity production of shallow work, such as ornamental hinges, skate keys, and various other sheet-metal articles that can be produced by progressive stamping, forming, curling, closing, piercing, and similar operations.

Blanking and drawing operations are not generally recommended for carry-motion presses. The blanks are usually, though not necessarily, cut out on a separate press and fed to the carry-motion press from a stack or magazine *A*, Fig. 1. This magazine is made to suit the shape of the blank.

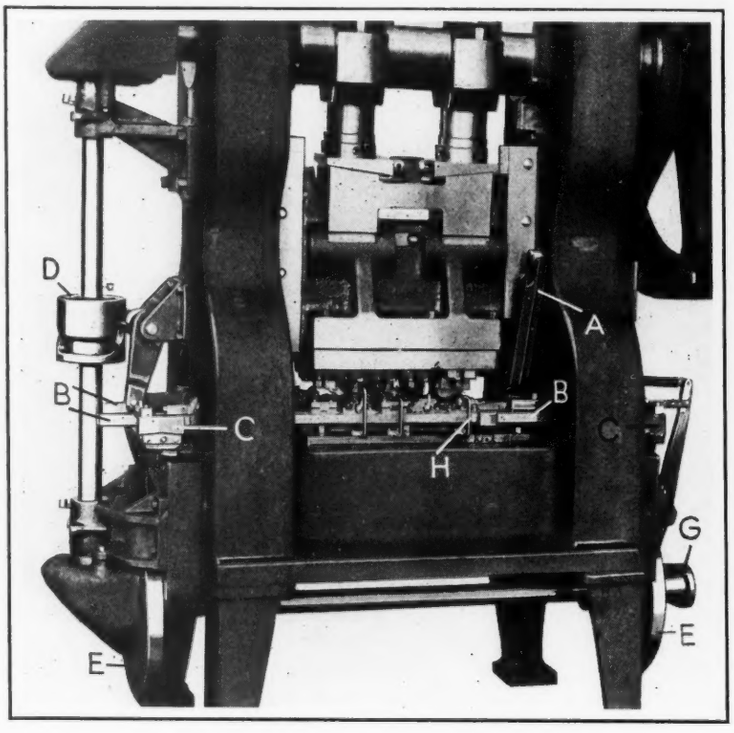


Fig. 1. Open-side Pillar Press Equipped with Transfer or Carry-Motion Feed

The carry motion, which is properly synchronized with the stroke of the press, picks up the pieces where they are delivered to the die by the magazine and advances them automatically, step by step, from the first to the last position on the multiple die. This is accomplished by having the bars *B*, on which the work-gripping fingers are mounted, operate as follows: (1) The carry bars move in until the fingers grip the work; (2) the bars rise, lifting the work; (3) they move to the left, carrying the work to the next station; (4) they then descend, so that the work is held by the fingers directly over the die; (5) the punch descends and the bars move outward, causing the fingers to release the work, which then becomes located in the die; (6) the bars slide to the right, returning the fingers to the starting position and thus completing the cycle.

In some cases, it is necessary for the punch to force the work from the fingers on the fifth motion, while in other instances, the conditions are such that the fingers must be withdrawn a little before the punch reaches the work in order to permit the work to drop out. In the latter case, it is often possible to design the die so that the work will drop into position unaided by guides or other means. The shape of the blank may be such that a knock-out is required in the first die in order to lift the blank to a position where it can be gripped by the fingers of the transfer mechanism. The character of the work that is generally handled on carry-motion presses, however, rarely requires the use of a knockout in the other die positions.

Design of Transfer or Carry-Motion Mechanism

The carry or transfer motion mechanism has two long parallel bars *B*, Figs. 1 and 2, which are a tongue-and-groove fit in the cross-slides *C* located at each side of the press. The bars *B* are reciprocated laterally by means of the barrel cam *D*, Fig. 1. In addition to the lateral movement, the bars are also moved up and down and in and out. These motions are derived from the double-path face cams *E* shown in Figs. 1, 2, and 3.

The up-and-down motion is controlled by the inner path of cam *E*, Fig. 3, the cam-roll *F* being attached to the vertical slide *G* on which the cross-slides *C* are fitted. The in-and-out motion is derived from the outer path of the cam, the cam-roll *H* being mounted on a secondary vertical slide *J* which has its bearing in the primary slide *G*. The movement of the slide *J*—see Fig. 2—causes the bellcrank levers *K* to pivot on slide *G*, Fig. 3, against the tension of coil springs. The bellcrank levers are connected to slide *J* by blocks *L* and to the cross-slides *C* by slots in which the rounded

ends of the levers engage. Thus, when the levers are pivoted as described, the cross-slides move in and out.

The feed magazine *A*, Fig. 1, is attached to the front carry bar *B* in such a position that the blanks drop from it to a plate between the two bars. From this position, the blanks are transferred by the feed slide *F*, Fig. 2, to the position indicated at *W*, Figs. 4 and 5. This slide is formed on the end to conform to the shape of the blank, and is actuated by cam *G*, Fig. 2, and a heavy coil spring *H*. Several pairs of fingers, formed on the ends to suit the contour of the work, are mounted on the front and rear bars, opposite the dies, as shown in Fig. 5.

Tooling Arrangement for Hinges

Fig. 5 shows a plan view of the dies, fingers, carry bars, etc., for producing the outer half of an ornamental hinge. The hinge is shown in various stages of completion directly over the dies and in line with the fingers. It will be seen that the first pair of fingers is attached to pivoted holders *E*, which are normally held parallel with the carry bars by a coil spring. This construction permits the fingers to adjust themselves to a common plane and thus compensate for the effect of burrs on the edges of the blank.

Fig. 4 represents a front elevation assembly of the hinge tools, showing the work in the dies and the punches down. The first operation consists of countersinking three holes, forming the ornamental end of the stamping and bending the tail ends. A section through the spring punches and punch-holder is shown at the right. The die for this operation requires two spring knock-outs *B* to raise the blank so that it can be engaged readily by the fingers.

Forming the Hinge-pin Eye

The second operation bends the tail ends preparatory to curling the hinge-pin eyes. It will be noticed that the work is located in the second-operation die at an angle, so that it becomes necessary for the fingers to swing to this angle before releasing the work. This is accomplished by designing the finger holders *D*, Fig. 5, so that they are free to turn in their bearings when the descending punch tilts the work to the angle of the die.

Sufficient friction is provided by spring *F* to hold the fingers in the angular position until righted again, when latch *G* is returned to its upright position by contact with wire stop *H*, shown opposite the countersinking die in Fig. 1. Referring again to Fig. 4, the third operation of curling is performed with the work lying flat on the die, as shown, which position it assumes when it is gripped by the fingers *H*, Fig. 5.

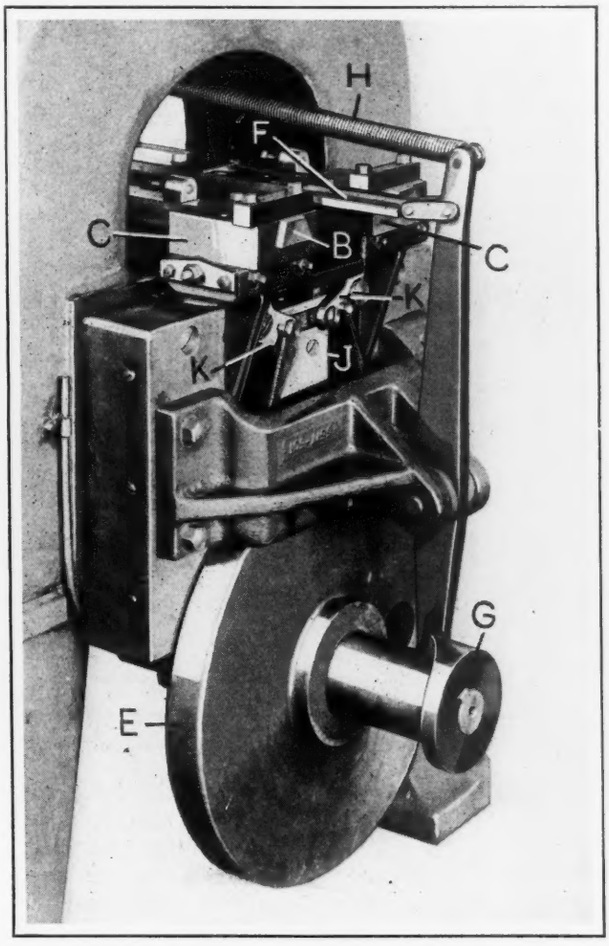


Fig. 2. Mechanism that Actuates the Six Motions of the Carry Feed Employed on the Press Shown in Fig. 1

Broaching Inner Faces of Hinge-pin Eyes

After the curling operation, the work is picked up by fingers *J*, which are attached to holders like those shown at *D*, and carried to the last die, where the fourth operation—broaching the inner faces of the hinge-pin eyes—is performed. Here the work is located in the die at an angle, being tipped by a latch and wire stop such as described in connection with Operation 2. Another wire stop of identical design rights the holders when the fingers are returned to the curling die.

The broaching operation squares up the opening between the hinge-pin eyes and provides the necessary clearance for the eye of the other half of the hinge. This operation requires a spring clamp, or punch stripper *C*, Fig. 4, which is attached to the punch-holder plate and holds the work down until after the broaching punch has ascended far enough to clear it. Then fingers *K*, Fig. 5, which are made with an angular groove at the end, engage the hinge, carry it to the left and release it. The work drops on an incline on the die bed, whence it falls into a tote box or other receptacle underneath the press bed.

The dies, it will be observed, are of built-up construction, and consist simply of machine-steel die-blocks with attached templets of hardened and ground tool steel for locating the work. The punches are also hardened tool steel. The shape of the hardened tool steel fingers, particularly at the holding ends, as well as the method of mounting the finger holders on the carry bars, will be easily under-

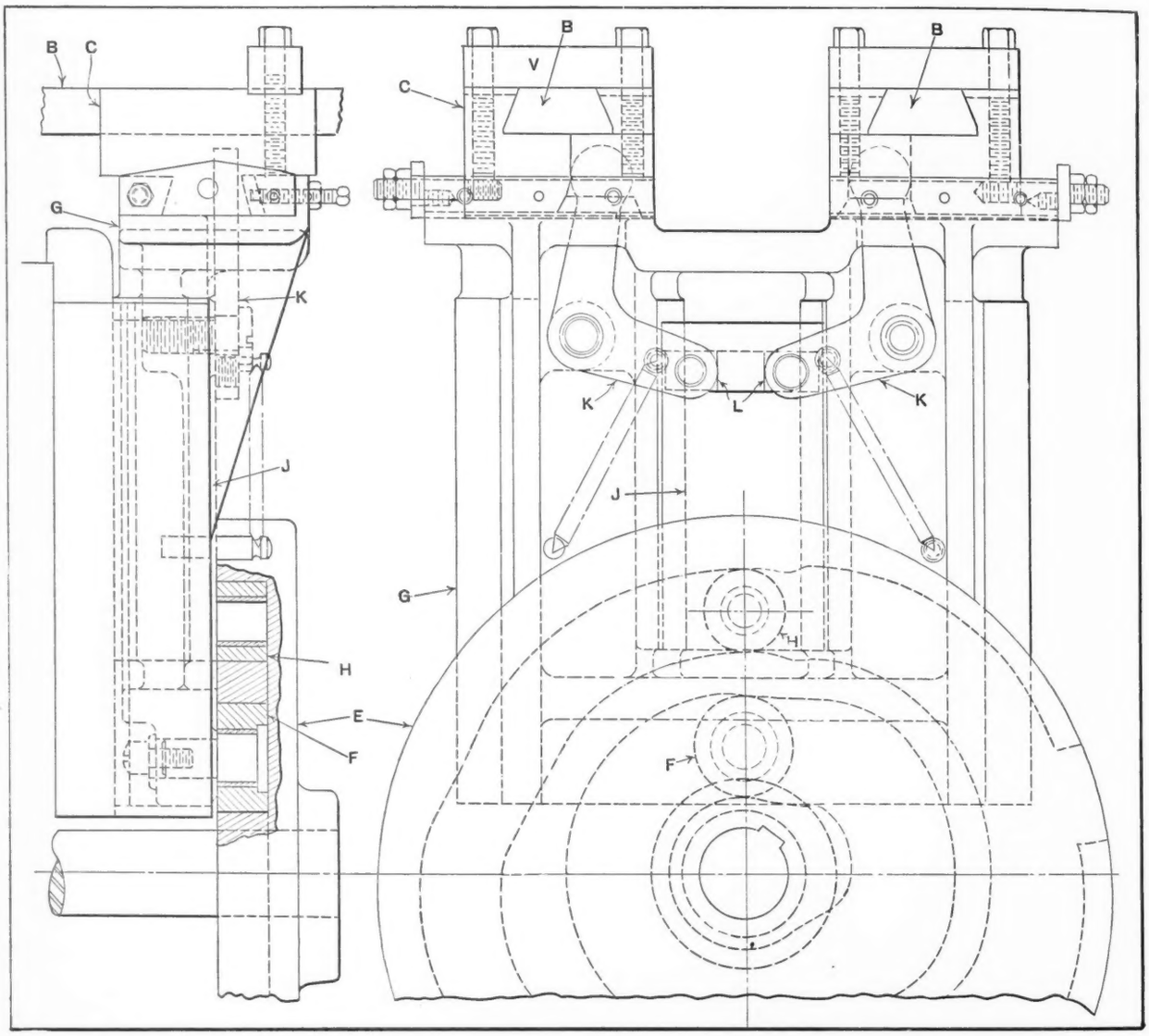


Fig. 3. Arrangement of Compound Slides for Operating the Carry-Motion Finger Bars B, Figs. 1 and 2

stood by reference to the sectional views at the right in Fig. 5.

Operations for Making Formed Bushings

Another simple example of carry-motion press work is shown in Fig. 6, together with assembly views of the tools required to fabricate it. The work is a special bushing having a bead at one end and a slot in one wall; it is produced in six operations. The stock may be either blanked out in a separate press and fed to the first die by a slide, the same as the hinge job was handled, or it may

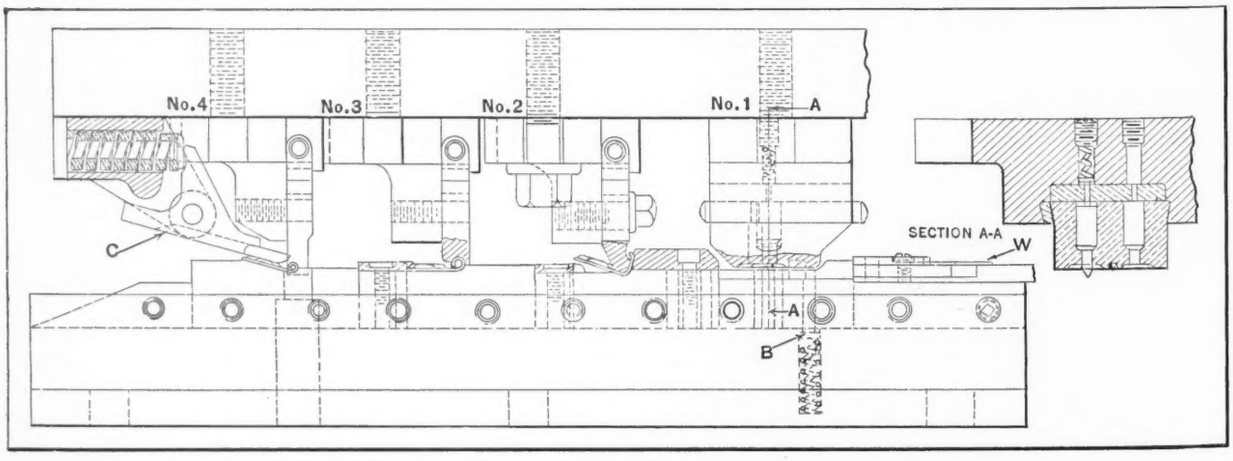


Fig. 4. Front Elevation View and Dies for Making Hinge Members

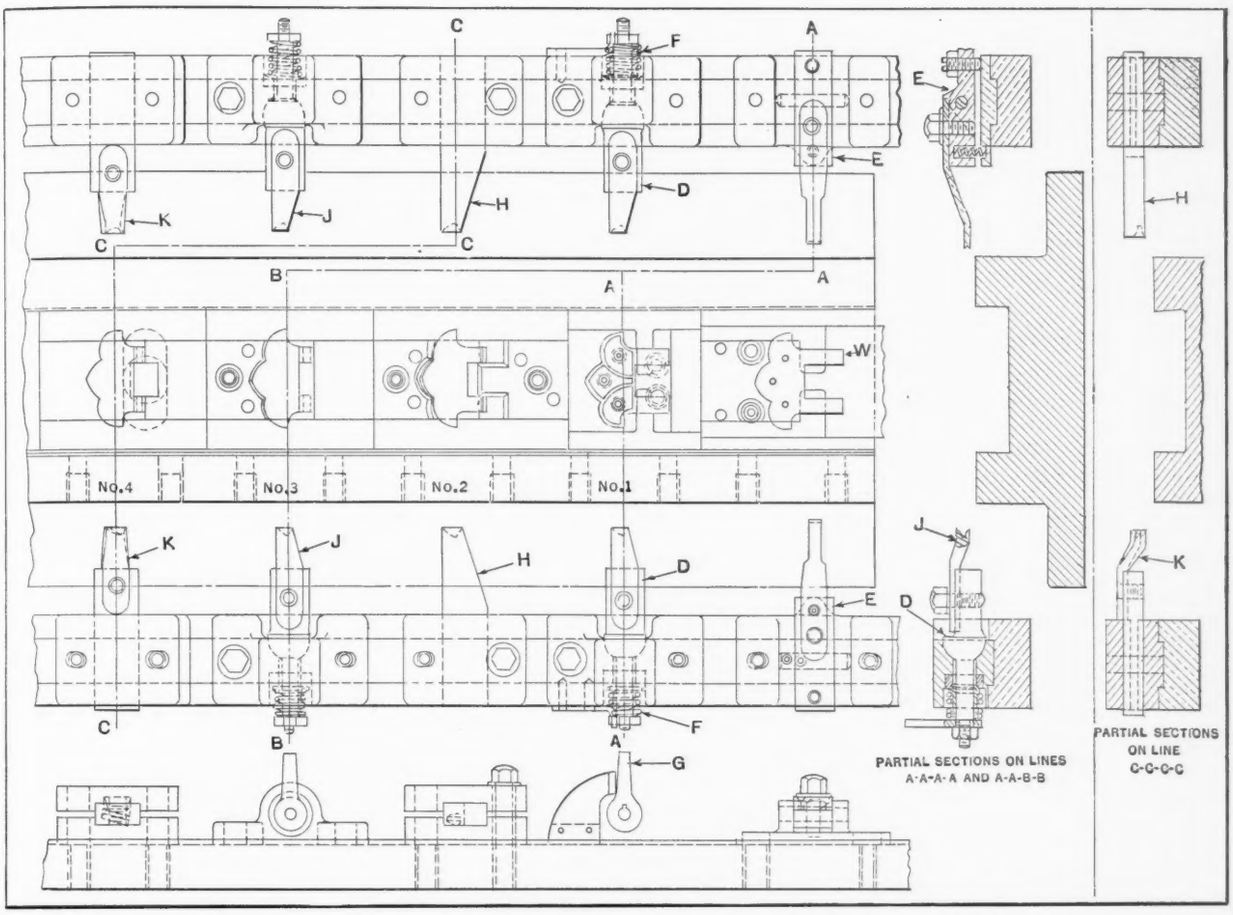


Fig. 5. Plan View of Dies and Transfer Fingers for Making Hinge Members, Showing the Stampings in Various Stages of Manufacture

be fed in strip form by a roll feed at the side of the press.

In either case, the metal passes between two guide blocks *A* and under pin *B*. It is stopped by a plate attached to the first shearing die-block *C* in the position indicated at *W*, and is held in this position by backing punch *D* while being squared on the end by shearing punch *E* and die blade *F*. The carry fingers next transfer the blank to the second die, where a groove is formed, and then to the third operation die, where it is formed as shown at *G*. The forming tools are made with a

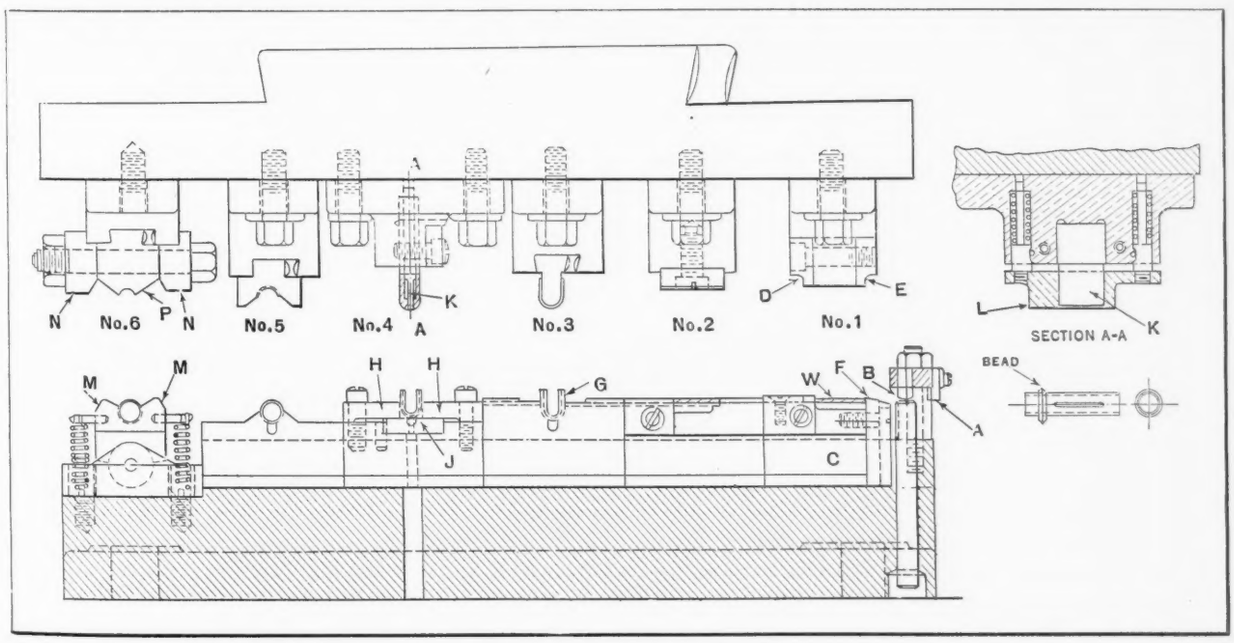


Fig. 6. Tooling for Manufacturing Special Formed Bushing on Carry-Motion Press

mating ridge and groove so as to maintain the shape of the bead formed in the second operation.

The fourth step consists of punching the slot. For this operation, the work is located upright between two machine-steel caps *H*, which hold the oblong die *J* in place on the die-block. The sectional view at the right shows the construction of the punch *K* and spring stripper *L* attached to the punch-block. The stripper is necessary, of course, to prevent the work from clinging to the punch, so that it will remain in position to be engaged by the fingers and transferred to the next die.

The fifth operation is that of curling, and the sixth is the closing or setting operation, which completes the bushing. The closing die is composed of two mating members *M* which are pocketed in a recess in the die-block where they are hinged together by a pin. The die halves are held slightly open by springs until the work is located between them, at which time the gate descends and the closing blades *N* force the die members together. At the same time that the bushing is being gripped in this manner punch *P* comes into contact with the work and die members, closing the edges of the metal together and producing a perfectly cylindrical bushing. As soon as the press gate starts to ascend, the die springs open and the fingers carry the work to the left and release it.

Materials Used for Tools

All punches and dies, the closing blades, the stripper plates, and the carry fingers are hardened tool steel, ground where necessary. The die-blocks and punch-holders, as well as the plates, guides, caps, etc., from which the dies are built up, are machine steel. The carry fingers are not shown in the illustration; they are arranged similarly to those shown in Fig. 5 but, of course, are shaped at the end to suit the work. Although the punches and dies are of comparatively simple built-up construction, the fingers must be carefully made to handle the bushing effectively.

While it is true that carry-motion presses will yield a greater daily production than can be obtained by other means of handling similar work, perhaps their greatest worth lies in the absolute freedom from personal injury that results from their use.

* * *

It is estimated that approximately $240,000,000 has been saved annually by fourteen industries through the adoption of simplified practice recommendations in cooperation with the Department of Commerce.

Handling Work in Progress Economically

A conveyor that moves 3,000,000 boxes a year between different departments in one of the largest manufacturing plants in the country will be described in February MACHINERY. This conveyor system serves six buildings containing more than 24 acres of floor space. Conveyors have proved so satisfactory in this plant that over 8 miles of them are now in use. They have solved the problem of traffic congestion in the aisles of the shops, have eliminated trucking of work in progress, and have greatly increased production. The conveyors extend directly to the machines, so that work is always on hand to keep the machines running. Furthermore, with such a system the operators strive to pass on finished work just as soon as possible to the next operator, in order to prevent congestion at their own machine.

FIFTIETH ANNUAL MEETING OF THE A.S.M.E.

The annual meeting of the American Society of Mechanical Engineers, held in New York December 2 to 6, was the fiftieth annual meeting of the Society. At this meeting sixty-five papers and reports on practically every branch of mechanical engineering were presented. Special session were held on hydraulic power, applied mechanics, hydraulic turbines, machine shop practice, power test codes, fuels, materials handling, cutting metals, mechanical springs, management, lubrication, use of engineering literature, education and training of non-college type for the industries, steam table research, central power stations, railroads, oil and gas power, metals, fluid flow, boiler feed water, aeronautics, textiles, and refrigeration.

The papers presented at the meeting of especial interest to those engaged in machine shop practice were as follows: "Quality Control and Production Gages," by Earle Buckingham, associate professor of engineering standards and measurements, Massachusetts Institute of Technology; "Turning with Shallow Cuts at High Speeds," by H. J. French and T. G. Digges of the United States Bureau of Standards; "Power Required to Drill Cast Iron and Steel," by O. W. Boston, professor of Shop Practice of the University of Michigan, and Carl J. Oxford, factory superintendent and chief engineer of the National Twist Drill & Tool Co.; "Test Code for High-speed Steel for Turning Tools," by Lewis H. Kenney, mechanical engineer, United States Navy Yard, Philadelphia, Pa.; "Progress Report of the Machine Shop Practice Division," by Kenneth H. Condit, editor of the *American Machinist;* and "Present Practice in the Use of Cutting Fluids," a progress report prepared by S. A. McKee of the United States Bureau of Standards.

* * *

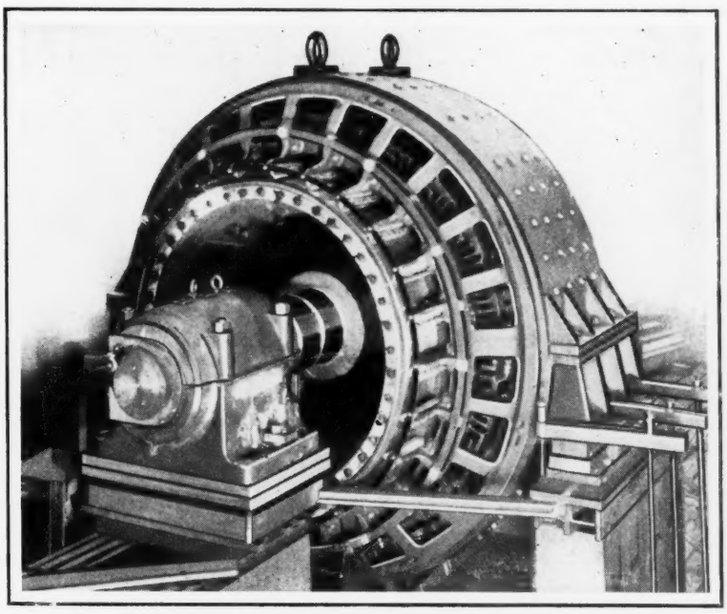
RELATIVE COST OF AIRPLANE ENGINES

The factory cost of airplane engines per horsepower is much less than that of marine engines and about the same as that of railroad locomotives, according to George J. Mead of the Pratt & Whitney Aircraft Co. He states, in a paper read before the Milwaukee Section of the Society of Automotive Engineers, that airplane engines cost about $18 per horsepower, as against $145 per horsepower for marine (steam or Diesel) engines, while a locomotive costs about $20 per horsepower, including the tender. The airplane engine will run without overhauling for 30,000 to 50,000 miles, compared with 30,000 miles for marine engines, 100,000 for locomotives, and 10,000 for automobiles.

Notes and Comment on Engineering Topics

The rapid development of the motor coach is well illustrated in the new "Nite Coach." According to a recent bulletin published by the Society of Automotive Engineers, this vehicle provides sleeping quarters for twenty-six passengers in thirteen compartments. It also has dining service, lavatories, and smoking and baggage compartments.

A development in the field of artillery shell production of interest to mechanical engineers is the substitution of seamless drawn tubes for hydraulically pierced shapes. This process was described in an article by G. P. McNiff in *Army Ordnance*. The main advantage of this process of manufacture is a saving in machining work; also, all machining can be done on the usual type of shop equipment, instead of requiring special single-purpose machines. In the case of 75-millimeter shells, the hydraulically pierced forging weighs 24 pounds, as against 17.25 pounds for the seamless tubing. This difference in the amount of metal to be removed results in a saving in time, as well as in transportation costs. In the case of 155-millimeter shells, the weight of the tubing blank is 127.8 pounds, as against 151 pounds for the old style forging.



A 7000-horsepower Westinghouse Reversing Mill Motor with Frame Welded from Four 15-ton Steel Slabs, 9 Inches Thick by 30 Inches Wide

A building 2000 feet high is possible as an engineering proposition, according to a report based on a study made by the American Institute of Steel Construction. The economic height, however, is reported to be much less, being sixty-three stories where the land is valued at $200 a square foot, and seventy-five stories where the land is valued at $400.

Machines are now used more and more to make many glass products, notably bottles and bulbs. Yet despite the inroads made by machinery in the glass industry, the number of craftsmen who are employed to make glass by hand, and blow it by their own lung power, is very large. Certain products still require hand labor. Such things as large flasks, chemical retorts, and big electric light bulbs for airport lights and other uses are made by hand almost exclusively. A great amount of glass tubing is still produced by hand methods.

Night flying with mail, express, and passengers is now being done on an extensive scale in the United States. According to the *Journal* of the Society of Automotive Engineers, the transcontinental air-mail route between New York City and San Francisco is the longest lighted airway in the world. On this 2700-mile span of plain and mountain between the two seaboards, are sixteen airports that receive calls at night from the mail planes; also 111 emergency fields, which are lighted, 232 revolving beacons of 24-inch size, and 529 blinker lights. Thus, the combination of regular and emergency landing fields and lights gives the transcontinental night flyer 887 lighted aids to air navigation. The policy is to install lights so that a flashing beacon will be located every ten miles or less, and because of visibility at elevations, this virtually gives the flyer an illuminating system that he can see continuously, provided the weather is favorable.

Beacons of comparatively small candlepower placed at close intervals are more desirable than high-powered beacons at greater intervals. The visibility range varies with the candlepower intensity of the beacons, but the rate of increase of visibility is substantially less than the rate of increase of the beacon candlepower.

During the first eight months of 1929, freight traffic totaled 325,388,114,000 net ton-miles. This is an increase of 11,030,634,000 net ton-miles over the previous high record of any corresponding period.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

LIFTING CLAMPS FOR LOCOMOTIVE TIRES

By H. H. HENSON, Foreman, Machine and Erecting Shop, Southern Railway Co.

The devices shown in Fig. 1 enable locomotive driving-wheel tires to be handled with rapidity and safety. The clamp illustrated by the two views at *A* is used for carrying the tire in a vertical position. By means of the chain the tire can be conveniently picked up by a traveling crane and transported about the machine shop or roundhouse. The offset lip and the set-screw of this clamp serve to hold the tire securely in place without danger of slipping while being carried about the shop.

A pair of lifting tongs for use in transporting tires in a similar manner is shown at *E*. These tongs are self-locking, that is, the lifting action of the crane serves to tighten the grip on the tire. The details and working dimensions of these tongs are shown in Fig. 3.

The grab hooks and chain shown at *C*, Fig. 1, provide a convenient means of picking up tires from a horizontal position. A plan view of one of the grab hooks is shown at *D*. This type of hook can be cut from 5/8- or 3/4-inch boiler plate by the use of an acetylene torch. The ends of the hooks are bent to conform to the shape of the tire flange. Another grab hook used for a similar pur-

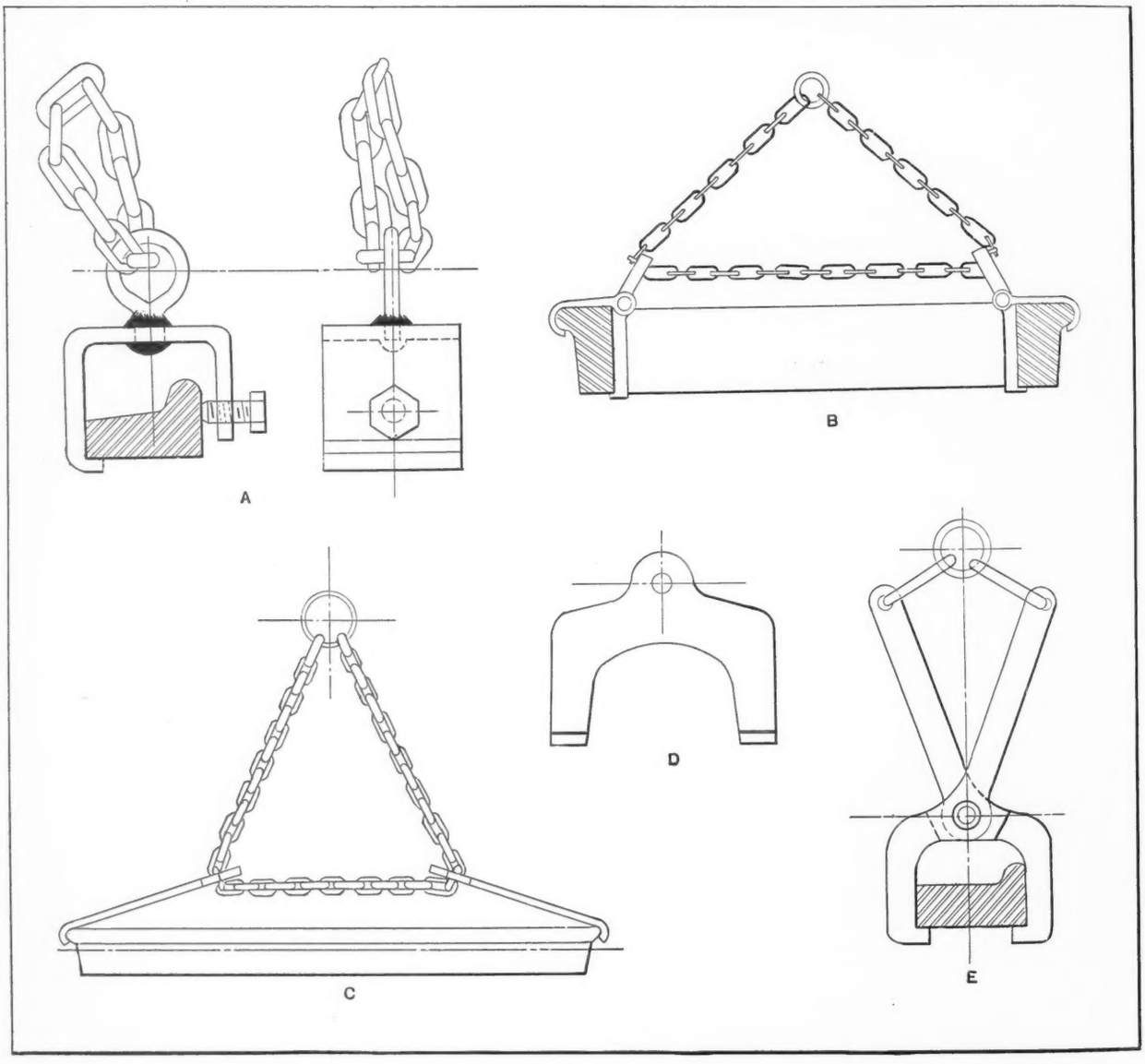


Fig. 1. Clamps and Tongs which Facilitate the Handling of Locomotive Tires by Overhead Cranes

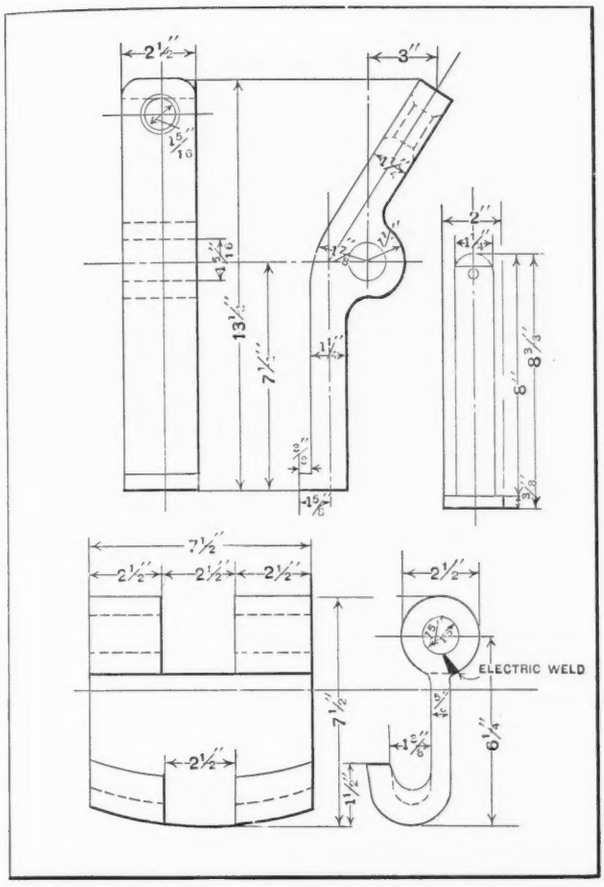


Fig. 2. Details of Lifting Hooks Shown at B, Fig. 1

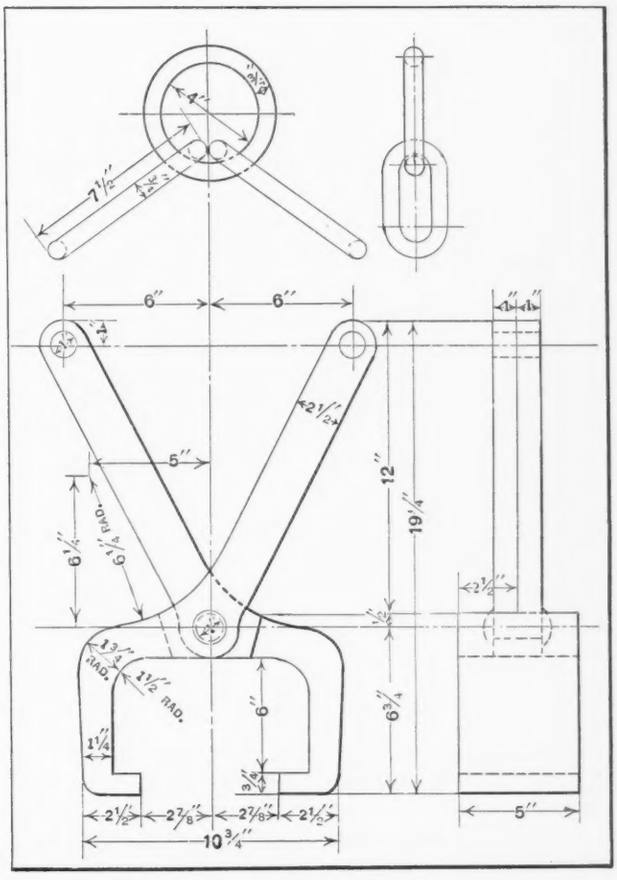


Fig. 3. Dimensions of Tongs Illustrated at E, Fig. 1

pose is shown at *B*. This hook obtains a more positive grip on the tire than the one shown at *C*, and is therefore safer. The part of the hook that is fastened to the chain has an offset lip that locks the tire securely in place when the lifting force is applied.

The details of the two members that form the hooks of the lifting device illustrated at *B* are shown in Fig. 2. When hooks of this kind are used, there is practically no danger of a tire being dropped in case an obstruction is struck while it is being transported through the shop.

* * *

FATIGUE CRACKS IN CAR AXLES

Bulletin No. 197 is the second of a series to be published by the Engineering Experiment Station of the University of Illinois in cooperation with the Utilities Research Commission on the subject of fatigue failures in car axles under repeated stress. It deals especially with the question whether it is safe to use axles in which small fatigue cracks have started, if these axles are turned down below the bottom of the fatigue cracks and then put into service under lighter loads.

This bulletin records fatigue tests on car axle steel as received, and on specimens of car axle steel which, after a fatigue crack had developed, were turned down slightly below the root of the crack, and their fatigue strength then compared with that of the virgin steel. Axles of several different kinds of steel furnished specimens for these tests, and testing machines permitting the use of two different sizes of specimens were used.

The results of this series of tests indicate that the practice of salvaging an axle in which a fatigue crack has developed by turning it down to a smaller size is safe, if the material is removed to a depth of at least 1/16 inch below the apparent bottom of the crack. If the material is removed only to the apparent bottom of the crack, the damaged material is not all removed, and the fatigue strength of an axle so treated may be materially less than would be expected from the fatigue strength of the virgin steel.

This bulletin also includes a brief summary of the previous work in the study of fatigue failure of car axles which is reported in Bulletin No. 165, the first of the series. Copies of Bulletin No. 197 may be obtained without charge by addressing the Engineering Experiment Station, University of Illinois, Urbana, Ill.

* * *

The practical value of research is pointed out by John Liston in the *General Electric Review* for January. He states that more than 20 per cent of the income of the General Electric Co. in 1929 represented electric apparatus which, as recently as a decade ago, was either unknown or of negligible importance commercially, and which has been developed through research during recent years.

Current Editorial Comment

In the Machine-building and Kindred Industries

A CAREFUL FORECAST OF 1930

If we group together the shops that produce machinery of all kinds, railroad repair shops, and plants producing metal articles and parts, we find that approximately 20,000 shops are engaged in such branches of industry. These shops employ over 1,800,000 wage earners, and the total value of their products is about $12,000,000,000 annually.

The total value of the products of the manufacturing plants in the United States aggregates $63,000,000,000. The machine shop industries produce approximately one-fifth of the total industrial output of the country, and a review of the conditions and prospects of business in these industries, therefore, is of great importance.

MACHINERY has asked more than 1400 executives in every branch of the machine-building and metal-working industries for their opinions on the 1930 business prospects and more than fifty different branches are represented in the replies obtained and summarized in the leading article in this number. In some instances these industries have been grouped together, like the electrical machinery and tool manufacturers, and the power plant equipment shops.

Especial interest attaches to the automobile industry, because the falling off in production of automobiles toward the latter part of 1929 has been regarded by many as an indication of a possible slump in that industry. The indications for 1930 are, however, that production of passenger automobiles, trucks, and buses, while not reaching the record-breaking figures of 1929, will exceed the output in 1928, which up to that time was the record year.

* * *

THE EFFECT OF MODERN PROCESSES ON MACHINE DESIGN

The work of the draftsman or designer is sometimes referred to as though it were not allied directly to manufacturing practice; but every one experienced in either branch of work knows that production costs may be affected decidedly by the design itself. It follows, then, that the designer posted on modern equipment and processes can begin the elimination of wasteful manufacturing practice right in the drafting-room. For this reason, the designer of today, as well as the shop executive, needs information about all current developments in equipment and processes. Most of the purely designing problems are solved by the application of formulas and principles not subject to change, but manufacturing methods are changing continually and the designer must know about these changes, if he is to assist in controlling the production costs and the quality of the product.

The competent designer is not satisfied with a mechanism just because it will function. When the required mechanical action has been obtained and all of the stress or other problems have been solved, the design is put on the dissecting table. Each part is examined with reference to possible methods of production. The influence of the design upon the work of the pattern shop, the foundry, the forging department, and the machine shop is carefully considered. The designer asks himself questions like these: Can the design as a whole be simplified? Can this part or that be machined more rapidly if its form is changed? Have the materials been selected both on the basis of good design and efficient production? Would it be possible to economize in the use of some new development in shop equipment by a practicable change in the design?

Every one who reads the New Shop Equipment section of MACHINERY appreciates the important relationship between the work of the designing and manufacturing departments. Then, too, there are the notable developments in steels, in high-strength cast iron, in non-ferrous alloys, and in other materials which also have an important effect upon design; but these achievements can be utilized fully only when designs are based upon materials and methods which pass the commercial as well as the purely mechanical test.

* * *

INVESTING IN "GOOD WILL"

Progressive business men fully appreciate the value of that intangible asset known as "good will." Although its actual value cannot be determined accurately, this asset is a vital one, particularly when the business man or manufacturer sells a service or some product relating to service. It is evident that there are many ways of creating good will, but all may be included under efficient service.

Frequently, good will can be acquired without cost merely by paying attention to details that are often considered unimportant. Did you ever visit one of those manufacturing plants where all who enter are evidently regarded with suspicion until proof to the contrary is forthcoming? The plan of according courteous, prompt treatment to all visitors has the merit, at least, of including those whose good will is worth having. Even such a detail as promptness in answering letters tends to create good will. This asset, once created, has self-propagating qualities, and represents real value, not only in dollars but in terms of a much higher order.

Determining Allowable Costs for Inspection

A Study of Inspection Costs as Related to the Plant Payroll and Percentages of Parts Rejected by the Inspection Department

IN interchangeable manufacturing, the cost of the inspection essential for maintaining the required standards of accuracy or quality varies considerably according to the nature of the work, the tolerances allowed, and the gaging methods employed. The allowable inspection costs and the percentage of the total production rejected by the inspection department are items of considerable importance to plant managers. The following information and specific data relating to these two subjects has been taken from a paper on "Quality Control and Production Gages" presented by Earle Buckingham, associate professor of engineering standards and management, Massachusetts Institute of Technology, before the annual meeting of the American Society of Mechanical Engineers.

Inspection Costs and Percentages of Scrapped Parts in Different Classes of Manufacturing Plants

The statistics on cost of inspection given in the following represent the per cent of payroll for inspection as compared with the total payroll factory cost of the product. The per cent of scrapped parts represents the per cent of spoiled parts as compared to the total production. An attempt has been made to separate these statistics into groups covering products that entail similar manufacturing problems.

Class A—Household and office appliances such as washing machines, sewing machines, calculating machines, typewriters, telephone equipment, etc.

Cost of inspection.....from 2 to 7 per cent
Scrapped parts .....from 1/2 to 5 per cent

These percentages vary in the different departments, depending upon the nature of the production methods and the design and requirements of the components involved.

Class B—Machine tools, electric motors, turbines, etc.

Cost of inspection.....from 5 to 7 per cent
Scrapped parts .....from 1 to 7 per cent

Class C—Automobiles, agricultural machinery, gasoline engines, etc.

Cost of inspection.....from 4 to 10 per cent
Scrapped parts .....from 2 to 7 per cent

Class D—Standard small tools, gages, etc.

Cost of inspection.....from 10 to 20 per cent
Scrapped parts .....from 5 to 25 per cent

Class E—Special tools, gages, fixtures, etc.

Cost of inspection.....from 25 to 50 per cent

Variation of Inspection Costs in Different Departments

The cost of inspection on different types of productive equipment, even in the same plant, or on different parts of the product, some simple and others more intricate, varies considerably. Thus in one plant with an average inspection cost of about 7 per cent, the inspection costs in different departments vary from 2 to 29 per cent. In another plant whose average inspection cost is about the same, the inspection costs vary from 1 to 67 per cent in different departments.

Even on the same type of manufacturing equipment, the inspection costs vary, depending upon the requirements of the product. For example, in automatic screw machine departments, the cost of inspection on the average product may be as low as 1 or 2 per cent, while on parts with very close tolerances where the product must be watched continually, this cost may increase to over 10 per cent.

One interesting example comes from a large plant manufacturing a wide variety of products. On two similar products, the first being quite completely tooled up and provided with gages for rapid inspection, while the second has a minimum of such equipment, there are the following percentages:

	First Example	Second Example
Cost of inspection.....	1 per cent	7 per cent
Scrapped parts	1/2 per cent	7 per cent

The initial gage equipment in one plant which is completely tooled up to manufacture a specialized product represents about $10 per employe, and the cost of gage maintenance is about one-tenth of 1 per cent of the factory cost of production.

Opinions Regarding Inspection Costs and Percentage of Scrap Tolerated

To obtain opinions and data on normal costs of inspection, percentage of spoiled parts, etc., letters were sent to a wide variety of industries asking for information. All replies did not give definite figures, but some responded with comments of value. Some of these comments are as follows:

The proportionate cost of our product in terms of gages or inspection cannot be given, as we do not segregate these costs on each individual article, due to the large number of articles manufactured and the extreme variation in design. We look upon gages and inspection in the same manner as we look upon machine tools, etc., namely, we consider them essential to the production of the article, and the degree of accuracy required depends, of course, upon the specific article under consideration.

Each workman, as well as tool-setter, tester, and inspector, contributes more or less in normal production to the cost of inspection. Consequently information of value relating to gaging or inspection as proportioned against other costs, such as material, overhead, etc., is not available.

As regards percentage of scrap tolerated, our ambition is to reduce this scrap to zero, which is an ideal hardly attained in practice. Each article

manufactured is treated as an individual problem, and we do not set any limit that might be termed allowable scrap.

Cost of Inspection Must Not be Made a First Consideration

Initially, with a new line of apparatus, the first consideration is not what inspection may cost, but rather how the specified performance, interchangeability, and uniformity can be met. It is the responsibility of the inspection department to see that these requirements are met with certainty. The use of gages is a great advantage, but obviously these can only be used for certain classes of work. In most cases, the inspector uses the same gages that are used for manufacturing, and therefore no additional expense is incurred except that of checking their accuracy. They are therewith able to inspect more quickly and accurately.

The problem of the inspection department is to perform its functions at the minimum cost. When this cost is high, either due to an excessive amount of defective work or parts, to lack of facilities for inspection, or to excessive variation from standard, it becomes a problem for the tool and production departments.

Whether it is cost of inspection or scrap expense, past experience in the same or a similar product, or the better performance of others, is the only dependable guide. Whenever anyone can show where there is an opportunity for the reduction of cost, or for a saving, the suggestions receive consideration, and if deemed worthy lead to a study or investigation.

Direct Labor Cost for Inspection May be but a Fraction of the Total Cost of Quality Control

The direct labor element of inspection may, of course, be a minor part of the cost of quality control. In some industries, it would be small in comparison with the laboratory tests performed on raw materials; in other industries it would be small in comparison to the amount of product consumed in tests. Quality control is so much a part of the duty of the whole manufacturing organization that it is impossible to estimate what proportionate share of the total cost may be attributed to it.

The amount of gaging on machine work depends on many factors. Its need decreases as the strength of the producing organization increases. It decreases with the continued familiarity of the whole organization with the task. It is necessarily large where a high degree of interchangeability is necessary, or where great hazard may exist if a product that is not up to standard is turned out.

The percentage of scrap tolerated depends on what the product is, and how stable the demand and therefore the organization. There is some fluctuation in the figures submitted when manufacturing is continually increasing its production, necessitating the training of new men.

The figures given do not represent the total amount of inspection work done by employes nor do they cover the cost of the variety of gages used through the factory, which is considerable. The greater part of the gaging may be done by the operators at the points where the different steps of manufacture occur. Often 50 per cent of an operator's time is spent in gaging the work he produces.

* * *

HIGH-SPEED MOTOR TRUCK ENGINES

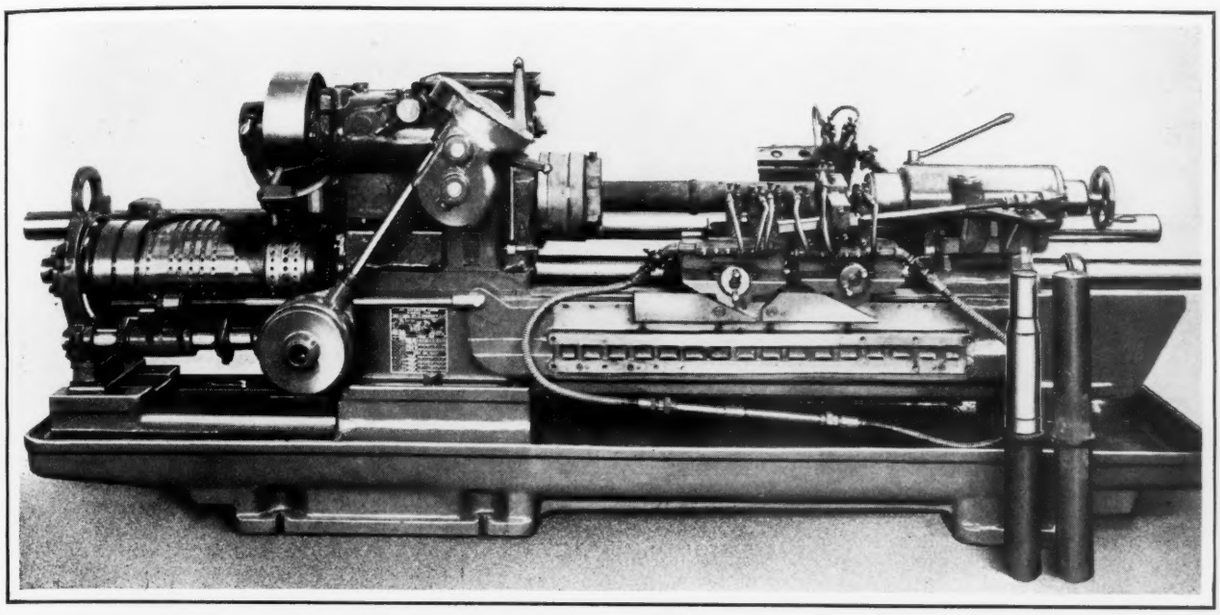
In a paper on "Six-cylinder Truck Engines," presented by Lewis P. Kalb at a meeting of the Society of Automotive Engineers, a comparison was made of the speed at which trucks operate today with that considered proper for vehicles of the same capacity only six years ago. The Motor Truck Standards adopted by the National Automobile Chamber of Commerce in January, 1923, recommended a maximum speed of twenty-five miles per hour for all vehicles operating on pneumatic tires, with a total gross load not exceeding 28,000 pounds. For solid tires they recommended that vehicles between 20,000 pounds and 28,000 pounds gross load restrict their speed to fifteen miles per hour.

If we go back still farther for a basis of comparison, the standard speed rating for commercial vehicles given in the S. A. E. Handbook dated September, 1918, is a maximum speed of sixteen miles per hour for 1000-pound trucks. For five-ton trucks the recommended speed is nine miles per hour, while for ten-ton trucks the recommended speed is five miles per hour. Today thirty-five to forty miles per hour is considered proper for even the heaviest vehicles, while the lighter or so-called speed trucks are expected to be capable of as high speed as most passenger cars.

Most of the increase in truck speed has been accomplished by running the engines faster. There was a time when 1000 revolutions per minute was considered the proper speed at which to govern the engine in a 3 1/2- or 5-ton truck. Today 1800 revolutions per minute is considered a rather conservative speed for a six-cylinder truck engine, while some operators object if the truck manufacturer suggests that they limit the engine speed to 2500 revolutions per minute. The six-cylinder engine has played a large part in this trend toward faster trucks. Without the six-cylinder engine, present-day truck speeds could only have been attained by means of greatly reduced gear ratios which would, in turn, have called for much bigger engines per unit of load carried. The six-cylinder engine has two distinct points of superiority over the four-cylinder engine that make it more adaptable to high-speed heavy-duty operation. One is its greater flexibility and wider range of power, and the other is its comparative freedom from vibration.

* * *

Two record-size turbine generators were completed and placed in service during the past year by the General Electric Co. One was a 208,000-kilowatt cross-compound unit, and the other, a 160,000-kilowatt tandem-compound unit, each the largest of its type so far constructed.



Turning Axle Shafts on Automatic Lathes

Application of Two Fay Automatic Lathes Tooled for Turning Opposite Ends of Tractor Rear Axle Shafts, so that the Cutting Time is Equally Divided and Each Machine Operates Continuously

By H. T. LAFFIN

THE problem of turning comparatively long, heavy shafts, such as those used in the rear axles of tractors, has been mostly a matter of obtaining a satisfactory rate of production. Since shafts of this general type may have six or seven different diameters and also several shoulders to be formed and located, it is evident that a machine equipped with multiple tools will reduce the turning time and insure accurate duplication of parts.

Usually on work of the general class mentioned, there will be one or two cylindrical sections that are much longer than the others, and again the use of multiple tools reduces the time, provided the tools are arranged to divide one long cut into several short ones. For example, if a section is 12 inches long, four tools may be used to turn it, one beginning where the following tool is to finish its cut, there being some allowance for overlap. By thus dividing what would otherwise be a long cut, the time can be reduced so as to equal approximately the time required for machining the other sections of the shaft; hence, the total cutting time is reduced to a minimum. This method of subdividing the cuts so that the entire operation is completed during the time required for a single short cut has been applied in connection with the particular shaft-turning job to be described.

The First Operation on the Shaft

Two 14- by 50-inch Fay automatic lathes are used in conjunction with each other for turning, preparatory to grinding, the shaft selected as an example. The heading illustration shows the machine as arranged for the first operation on the shaft illustrated in Fig. 1. This operation is on the right-hand section of the shaft and includes three cylindrical surfaces and a 15-degree taper, the shaft being turned up as far as the 4 1/8-inch by 1/2-inch collar.

At the right-hand end of the machine in the heading illustration is shown the rough forging (the dimensions of which are given in the upper view of Fig. 1) and also the half turned shaft. This shaft is made of chrome-nickel steel, of S.A.E. composition 3140. The forgings, as delivered to the machine, are milled to length and have both ends centered. The machine employed for the first operation is equipped with five turning tools and a taper turner on the carriage, while three tools for facing and chamfering are mounted on a back arm, as shown in the illustration.

Arrangement of Tools for First Operation

If we assume that the tools at the front are numbered from 1 to 6, beginning at the left, tool No. 1 turns the section having a diameter of 3.647 inches (see Fig. 1); tools Nos. 2, 3, and 4 turn most of the 3 1/2-inch section, which is the longest on this end. Tool No. 5, the position of which is controlled by a cam or former, turns the tapering section and short cylindrical sections to the right and left of the tapering part; and tool No. 6 turns from the

extreme right-hand end of the shaft far enough to overlap the surface turned by tool No. 5. The tools on both machines are 3/4- by 1-inch in cross-section.

The longest cut during the first operation, is 4 inches, and with this multiple tool arrangement, the shaft is turned to a total length of 17 1/4 inches in 4 minutes and 53 seconds, which represents the floor-to-floor time. The cutting speed is 50 feet per minute, using high-speed steel tools, and the feed, 0.019 inch per revolution. While these different sections are being turned, the back arm moves in at the proper time and chamfers the end of the shaft to an angle of 45 degrees, and at the same time the other back arm tool faces the end of the shaft.

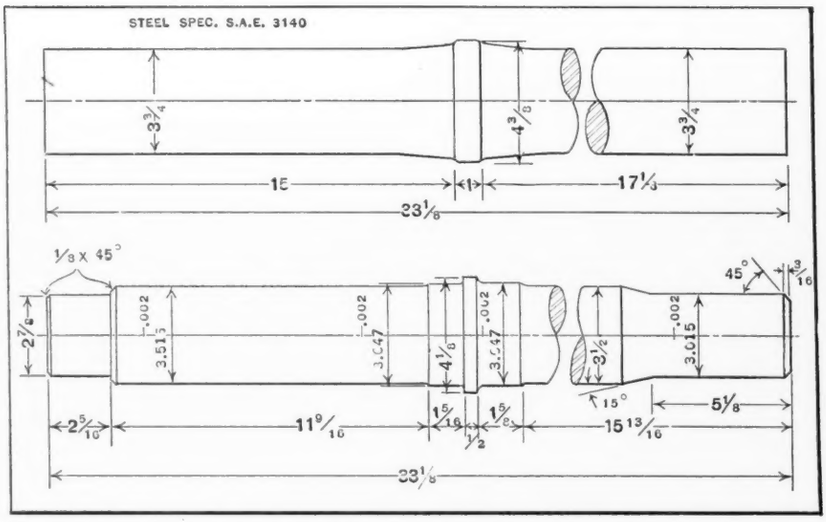


Fig. 1. (Upper View) Rear Axle Shaft Forging; (Lower View) Turned Shaft which is Finished by Grinding

Second Operation on Shaft

The half turned forgings are taken directly from the first machine to the second. These machines face each other, and the operator stands between them for convenience in loading. After removing the shaft from the first machine, the operator turns it around and places it in the other machine for the second operation. While the second machine is running, the first one is being loaded, and both machines are kept running continuously, because the floor-to-floor time of 4 minutes and 53 seconds for the first operation is almost exactly balanced by a floor-to-floor time of 4 minutes and 51 seconds for the second operation.

When the operator places the partly finished shaft in the second machine, he merely inserts the work between the centers; adjusts the tailstock center; locks the spring center in place in the spindle, which definitely locates the shaft; closes the steadyrest; and starts the machine. The steadyrest, which is shown in the open position in Fig. 3, is

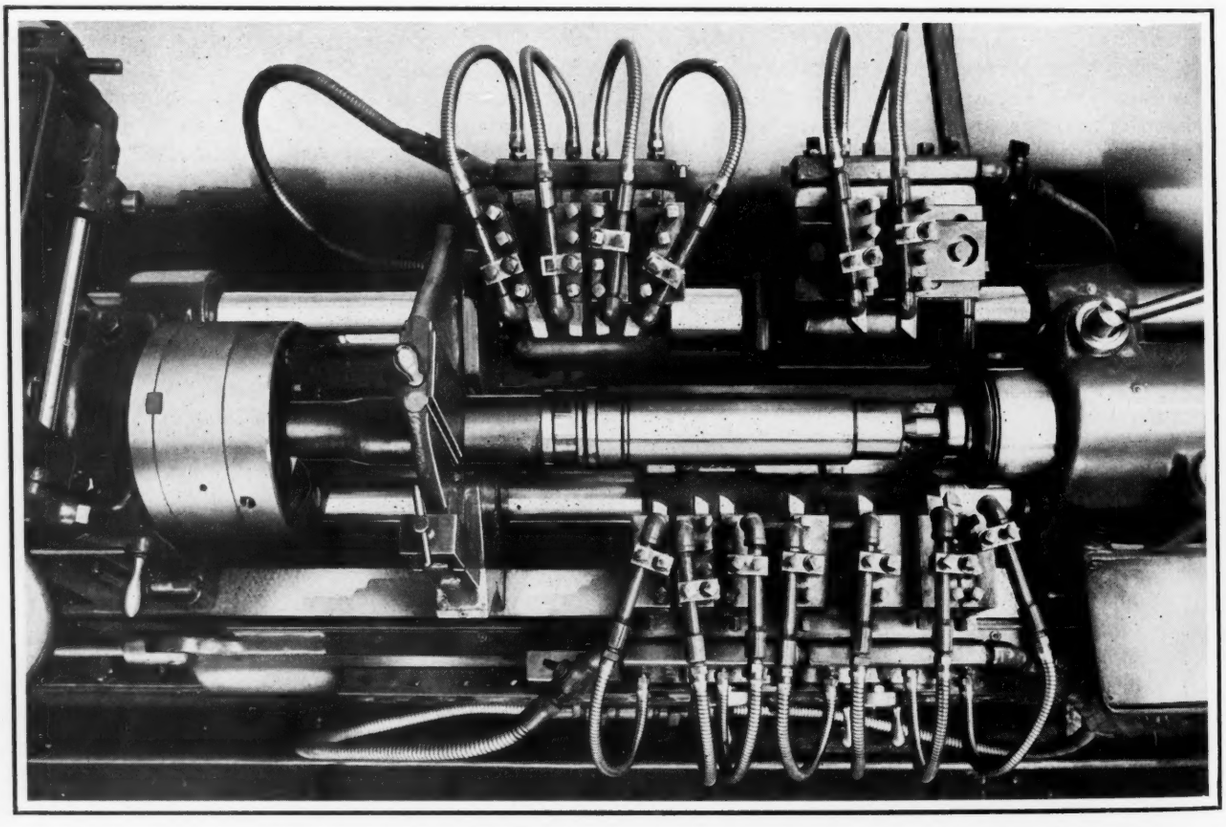


Fig. 2. Plan View of Fay Automatic Lathe, Showing Tools on Carriage and Back Arms for Second Operation on Rear Axle Shafts

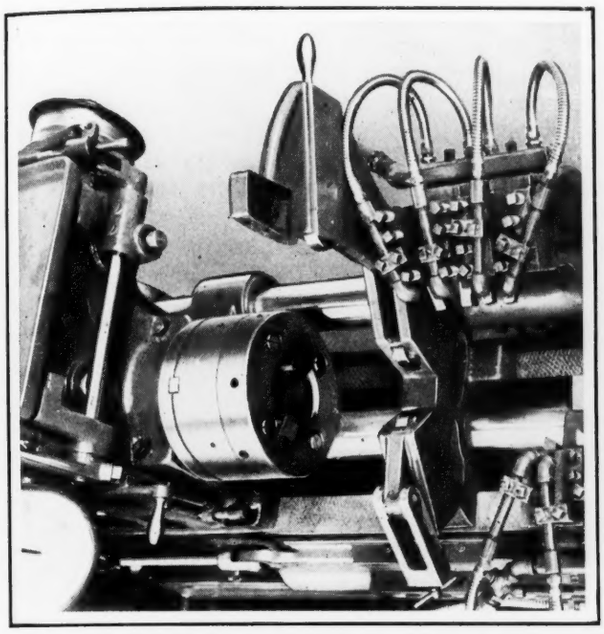


Fig. 3. Plan View, Showing Two-jaw Eccentric Drive Fixture and Steel Steadyrest which has Ball-bearing Rolls

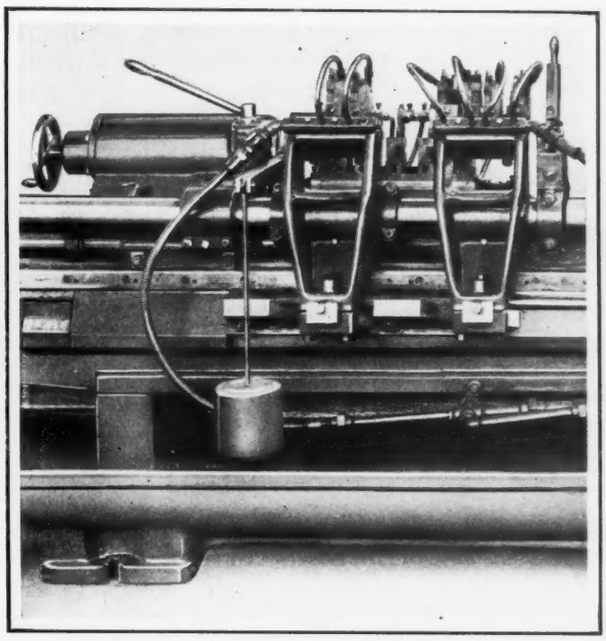


Fig. 4. Rear View, Showing the Two Back Arms and the Solid One-piece Former Slide which Operates Them

equipped with ball-bearing rolls which have a three-point contact with the shaft.

Fig. 2 shows a plan view of the tool equipment for the second operation. Seven tools are mounted on the carriage and six tools on two back arms for facing shoulder lengths and chamfering. The operations performed by the carriage tools, assuming that they are numbered from 1 to 7 beginning at the left, are as follows: Tool No. 1 turns the 1/2-inch collar to a diameter of 4 1/8 inches; tool No. 2 turns the adjoining section to a diameter of 3.647 inches; tools Nos. 3, 4, 5, and 6 are spaced to divide equally the turning of the long section to a diameter of 3.516 inches; and tool No. 7 turns the smaller 2 7/8-inch section at the end of the shaft.

The right-hand back arm carries two chamfering tools, and the four tools in the left-hand back arm face the four shoulders indicated on the drawing of the shaft in Fig. 1. These shoulder-facing tools cut slightly below the previously turned surfaces to provide clearance spaces for the grinding wheel. Fig. 4 is a rear view of the two back arms, and illustrates the solid one-piece former slide which operates them.

The cutting speed of the carriage tools is 50 feet per minute, and the feed, 0.019 inch per revolution, the same as for the first operation. The longest cut is 3 7/8 inches, which is practically equal to the longest cut of 4 inches for the first operation. The two machines produce nine completely turned shafts per hour, one operator running both machines.

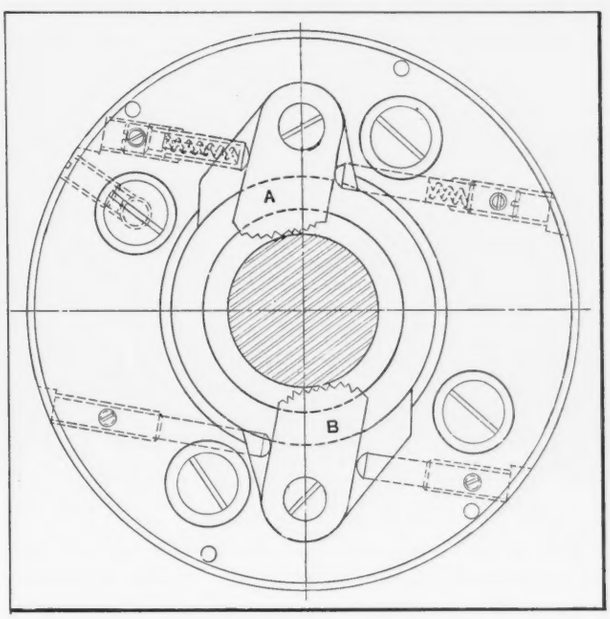


Fig. 5. Two-jaw Eccentric Drive Fixture which Tightens its Grip as Resistance to Turning Increases

Special Two-jaw Eccentric Drive Fixture

Both machines are equipped with a two-jaw eccentric-drive fixture. This fixture is shown in Fig. 3, and the arrangement of the jaws relative to the work is illustrated in Fig. 5. All parts of this fixture are made of hardened steel. The two driving jaws *A* and *B* have serrated surfaces or V-shaped ridges which engage the work. These serrated surfaces are milled eccentric to the jaw pivots, so that any tendency of the work to remain stationary when the spindle is rotating causes the eccentric surfaces to move inward, thus gripping tighter and driving harder as resistance increases. With this arrangement, the heavier the cut, the tighter the grip, so that possibility of slippage is eliminated.

Both jaws are set into the face of the chuck body and are rigidly supported by the body itself, as the circular outer ends rest against circular supporting surfaces milled into the chuck body. The jaws are held in contact with the work by springs which are opposed by

somewhat lighter springs on the opposite sides to enable the operator to load the machine easily. In loading, the operator merely places the work between the centers and pulls the starting lever which revolves the spindle and drive fixture, causing the jaws to grip automatically. In removing a turned shaft, the operator first withdraws the tailstock center, which drops the weight of the shaft on that end, thus releasing the jaws. The body of this driving fixture floats on an adapter plate, which is bolted to the spindle nose, thus equalizing the drive between the two jaws and eliminating any driving pressure from the headstock center.

* * *

NEW METHOD OF REMOTE MACHINE CONTROL

A recent invention which promises considerable application in both near and remote machine control by electrical means has been developed by the Bishop Wire and Cable Corporation, 420 E. 25th St., New York City. The new method of electric control consists of a waterproof, dustproof, and acid-proof cable, the diameter of which is about the same as that of an ordinary lead pencil. The cable, when compressed at any point along its entire length, may be arranged to throw a switch, turn on a light, sound a signal, or perform any other service that could be effected by direct contact through a button and switch at a stationary point. In other words, the cable is a continuous switch along its entire length, and may be anywhere from a few feet up to several hundred yards long.

The construction of the cable is briefly as follows: Two conductors, enclosed by the outside insulation, are left bare, but separated from each other by an "isolating cushion" of rubber. When pressure is applied, this isolating cushion yields and permits the outer conductor to come in contact with a wire which, in turn, is always in contact with the inner conductor, thus closing the circuit. When pressure is relieved, the isolating cushion returns the outer conductor to its normal position. Used with a relay switch, the cable becomes operative at the point of pressure—wherever the operator happens to be standing.

* * *

According to a statement made before the National Screw Thread Commission, more than 50,000,000 bolts, nuts, and screws are manufactured in the United States daily.

LUBRICATION OF BEARINGS IMMERSED IN WATER

A lubricant for under-water service should have the necessary qualities to insure adhesiveness and resistance to the action of the water. According to *Lubrication*, these qualities are generally found in animal oils or soaps which tend to emulsify in water.

In a grease the soap content is important. To be non-soluble, it must be of a lime or calcium base. If a soda soap were used, due to the fact that this is normally soluble in contact with water, the soap would be dissolved, rendering the grease incapable of maintaining effective lubrication, especially if there were any possibility of its being washed out from between the bearing elements.

It is also important to remember that wherever water conditions may prevail, there will be the possibility of comparatively low temperatures developing, especially on material-handling equipment in the coal mine or where pneumatic tools are involved. As a result, the oil content of any grease to be used for such service should have as low a pour test as possible.

Where there is provision for oil lubrication on machinery subjected to water conditions, the oil must be studied from the viewpoint of its adhesive characteristics as well as its pour test. In oils for such service, the emulsifying constituent is normally an animal oil, although in marine service it is customary to use rapeseed oil to develop the same characteristic in marine engine oils.

Animal and vegetable oils are commonly called fixed oils. They are adhesive to metal, incapable of distillation, and have the ability of uniting with water to form a tenacious lubricating film. In general, this film will be comparatively permanent, whereas an emulsion which may be developed by a mineral oil alone, when agitated with water, will be more or less temporary, depending upon the degree of refinement of the oil. It is inadvisable, however, to depend upon the emulsifying characteristics of a mineral oil alone; hence, the custom of adding a few per cent of fixed oil to render emulsification more positive. The amount of such compound will depend upon the service involved.

* * *

In a search for a cheaper substitute for platinum in engineering work, alloys of rhodium have been produced by the Bureau of Standards. These alloys have been used for electric furnace windings and have given good results in service.

Laboratory Aids Tool Development

The performance of metal-cutting tools depends mainly on three factors—the material from which they are made, the design of the tools, and the workmanship. A special laboratory is maintained by one of the well-known tool manufacturers for the purpose of testing all three of these factors thoroughly before a new product is placed on the market. In this way, it is possible to determine definitely the value of different types of design. Whether flutes should be right- or left-hand spiral, for example, has been a matter of argument in many cases; this can be settled in the laboratory. The most desirable cutting angles, number of flutes in tools, the value of different kinds of steels, the value of different finishes in the flutes, and dozens of other factors can thus be conclusively determined. The leading article in February MACHINERY will describe this laboratory, and will explain the use to which it is put and the results obtained.

Hydraulically Operated Machine Tools

Functions of Hydraulic Transmissions as Applied to Many Different Types of Modern Machine Tools

ONE of the outstanding developments in machine tool design is the extensive application of hydraulic transmissions to various types and designs of machines. Although such transmissions have long been applied to certain classes of presses, to testing machines, and to many other kinds of apparatus, especially where an even, powerful movement is required, until quite recently there have been comparatively few hydraulically operated machine tools. At the present time, however, many purely mechanical transmissions have been replaced by hydraulic types for actuating the work-holding tables of some machines, the tool-holding slides of others, and also for certain auxiliary functions mentioned later.

In addition to broaching machines, which have been hydraulically operated for some time, there are now quite a large number of hydraulically operated grinding machines, including cylindrical, surface, internal, and special types. The application to drilling machines also has been quite extensive, and includes the vertical type in single- and multiple-spindle designs, the horizontal type, and the radial type. While most of the applications have been to grinding machines and drilling machines, quite a number of other machine tools have been equipped with hydraulic transmissions, as shown by the accompanying table. This table may not include every type of hydraulically operated machine tool manufactured, but it does list representative types and also shows just how the hydraulic transmission is utilized in each case. This list is based upon machine tools of very recent design.

As the table shows, the function of the hydraulic transmission almost invariably is either to traverse the work or whatever tool or grinding wheel operates on the work. The two types of chucking machines listed are an exception, since in this case the operation of the work-holding chuck is hydraulic. Certain other exceptions will be noted in the column headed "Application of Hydraulic

Machine Tools Equipped with Hydraulic Transmissions

Kind of Machine Tool	Type or Design	Application of Hydraulic Transmissions
Broaching machines	Vertical (Two makers)	Broach slide movement
	Horizontal (Two makers)	Broach slide movement
	Surface	Broach slide movement
Chucking machines	Five-spindle	Operation of chuck
	Single-spindle	Operation of chuck
Drilling machines	Vertical station drilling	Spindle feed
	Vertical multiple head	Spindle feed
	Vertical (Three makers)	Spindle feed
	Horizontal	Spindle feed
	Radial	Column binder for arm
	Radial	Feed, spindle traverse, and arm clamping
	Gang	Indexing table operation and clutch
	Multiple-spindle (Two makers)	Spindle feed
	Two-way drilling	Spindle feed
Grinding machines	Cylindrical (Two makers)	Wheel-slide cross traverse
	Cylindrical (Three makers)	Work-table traverse
	Surface (Three makers)	Work-table traverse
	Surface	Work-table traverse and cross-feed of table
	Internal	Traverse of work-holding head
	Crankshaft bearing	Wheel-slide cross-feed
	Crankpin	Work-table traverse, wheel-slide, cross-feed, and work clamping
	Crank	Work-table traverse and wheel-slide cross-feed
	Cam	Work-table traverse and wheel-slide cross-feed
	Oscillating for ball races, etc.	Work-head oscillation
	Deep-hole	Wheel-slide traverse parallel to axis of work
Honing machine	Multiple-cylinder	Spindle-head reciprocation
Lathes	Automatic	Longitudinal and cross feeds
	Turret	Longitudinal feed
Milling machines	Plain	Table feed
	Duplex	Table feed
	Automatic	Reciprocation and indexing of table
Planers	"Shaper-planer"	Table movement and feeds
Reaming machines	Vertical	Reamer slide movement
Sawing machines	Circular saw	Operation of work clamp
	Circular saw	Movement of saw slide

Transmissions." In the case of grinding machines, the traversing of the work is the most general application, but in some instances, the hydraulic transmission is utilized for the cross traversing movement of the wheel, particularly when grinding between shoulders or wherever considerable wheel-slide movement is required. Properly designed hydraulic transmissions have the advantage of a relatively smooth action and a greater flexibility of control, which is of especial importance on certain types of machine tools.

* * *

MEETING OF AUTOMOTIVE ENGINEERS

The annual meeting of the Society of Automotive Engineers will be held at the Book-Cadillac Hotel in Detroit, Mich., January 20-24. A very large number of technical papers will be presented, of interest to both the automotive designer and the production engineer. Sessions will be held on front wheel drive research, noise prevention between chassis and body parts, aeronautics, carburation, engine bearings, Diesel engines, body design, new developments and inventions, and metallurgy as it affects the automotive industry. A production session will be held Wednesday evening, January 22, at 8:00 P. M., when Dean Dexter S. Kimball of Cornell University will speak on Economics of Production.

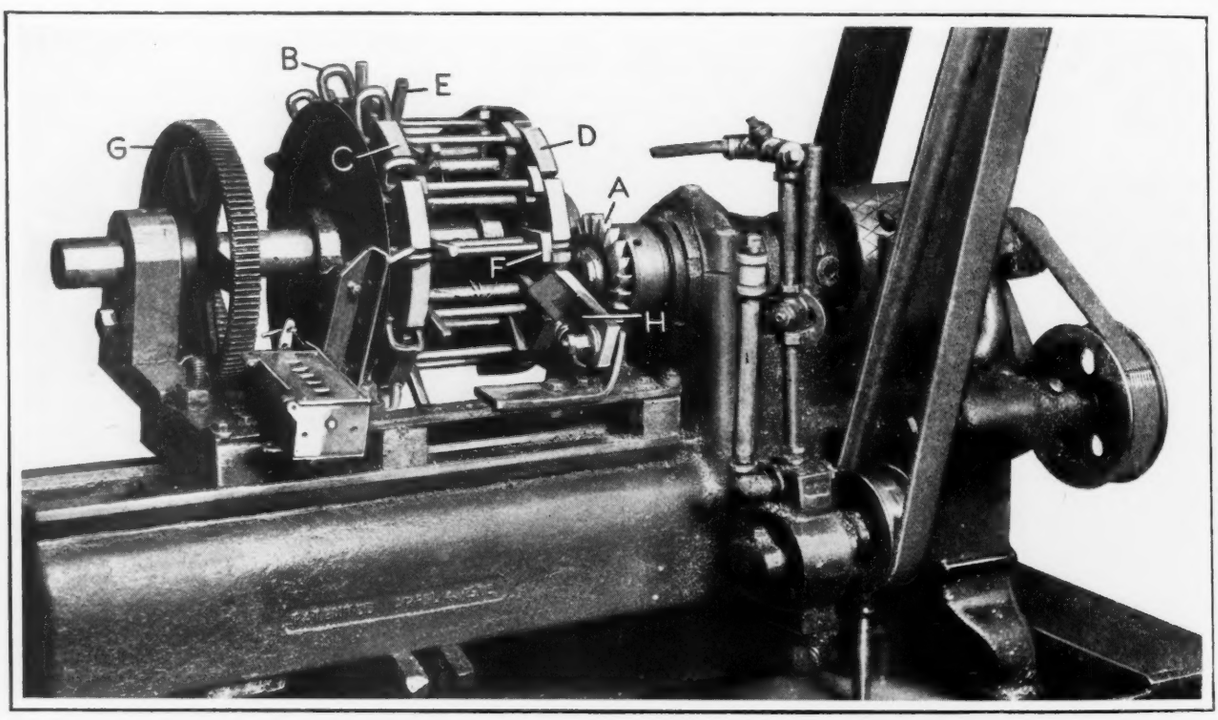
* * *

The motorcycle is enjoying increasing popularity in Czechoslovakia. Out of 60,000 vehicles of every class registered in February, 1928, 20,006 were motorcycles. One-third of this number were of English make.

HIGH-PRODUCTION MILLING OPERATION ON HAND SCREW MACHINE

Six hundred forged handles are milled to length per hour at the plant of the Alemite Corporation in Chicago, Ill., by employing a hand screw machine set up as shown in the illustration. It will be seen that a face milling cutter *A* mounted on the work-spindle, mills the handle forgings *B* as they are carried past it by a constantly rotating drum that is comprised mainly of plates *C* and *D*. This drum is driven by a shaft which extends along the front of the bed and receives power from the headstock.

A girl operator merely places the handles in the slots of plates *C* and *D* and at the same time pulls forward corresponding levers *E*. Each of these levers has a curved slot which slips over the left-hand shank of the handle to be machined. On the same shaft with each lever *E*, there is a clamp such as seen at *F*, which is simultaneously pulled over the opposite end of the work-piece. By this arrangement, the handles are held in the slots of plates *C* and *D* as they are carried to the cutter. Each handle is located for length by one end coming in contact with the disk at the left of plate *C*.



Milling Handles to Length on a Hand Screw Machine at the Rate of Six Hundred per Hour

Viewing the operation from the left-hand end of the machine as illustrated, both the cutter and work-drum revolve counterclockwise. Just before each handle is brought upward to the cutter, the corresponding clamp *F* comes in contact with the under side of the spring-actuated block *H*, which causes clamps *E* and *F* to be pulled down firmly on the work-piece and to hold it rigidly for the operation. Before this set-up was devised, a far more expensive machine, operated by a man, was used, and the production rate was much lower.

What MACHINERY'S Readers Think

A Department for the Interchange of Ideas on Problems of Management, Foremanship, and Employe Relations

PRICES FOR REPAIR PARTS

The subject of setting prices on repair parts, brought up in the article entitled "Prices for Repair Parts" in August MACHINERY, page 919, concerns every manufacturer. There seems to be no standard method of determining a fair price for such parts. So many variable factors are involved that it appears necessary for each manufacturer to determine his own method.

When models change but seldom, spare parts can be taken from current production stock and thus need not be kept in storage for long periods. In such cases, the parts can be priced moderately. When parts for old models are desired and it is necessary that they be made up in small quantities or stored for long periods, the cost must, of course, be comparatively high.

It is usually a mistake, however, to adopt the practice of charging "all the traffic will bear." A customer naturally resents being charged $5 for a part that he knows can be made for less than a dollar. Nothing makes a man decide to buy some other machine more quickly than a few repair bills for parts at what he considers exorbitant prices.

HARRY KAUFMAN

KEEPING SPECIFICATIONS UP TO DATE

The article "Keeping Specifications Up to Date" on page 13 of September MACHINERY presents an accurate summary of the situation. A great deal of the difficulty may be traced to the tendency to "invent" specifications. The specifying of any material in detail presupposes an intimate knowledge of the industry that produces the material. We cannot reasonably assume that one individual possesses all the specialized knowledge required to cover adequately the wide range of unrelated materials employed in most industries.

In some cases, specifications are literally "invented" in order to make an impressive showing. This results in paying unnecessarily high prices and delaying delivery. In many cases, it also restricts competitive bidding to one or a few concerns. Under such conditions, a dealer who knows of the use to which a material is to be put can safely offer regular or inferior material at higher prices as a substitute for the material for which fancy specifications have been written.

Greater efficiency in writing specifications can be achieved by closer cooperation with the basic industries producing raw materials. The engineering societies have done a great deal in simplifying and standardizing specifications. Many standard material or product specifications are furnished by these societies. These should, of course, be used when applicable. The Federal Specification Board issues master specifications which are mandatory on all government departments and which are the result of close cooperation with industry. These specifications should also be made use of.

The manufacturers of basic materials are also prepared to supply technical information concerning any of their products, which can be put into form for specifications. Only in cases where investigations have proved that a new or special material is highly desirable should an "original" specification be employed. In general, avoiding "original" specifications wherever standard commercial specifications are suitable will result in lower costs and the elimination of delays and controversies.

DONALD R. WATSON

BUY RESULTS NOT MERE MATERIALS

It has been proved that the best method of selecting new equipment is by the competitive performance test. Prices alone should be disregarded when it is evident that a machine or piece of equipment will pay for itself in a short period of time. If a new piece of equipment will do the work of several older machines, occupy less floor space, and thus reduce overhead expenses, all these factors should be taken into consideration. Bearing this in mind, let us buy the machines that tests show to be most efficient and prove by additional profits that it pays to buy on performance. The old trading methods that considered price first of all are out of date in modern shop practice.

PETER DE PASQUAL

ACCEPTING RUSH ORDERS

Naturally it is the tendency for sales managers to accept all orders, including "rush" orders, without giving much thought to the production capacity of the shop. In many cases new men must be hired and new equipment bought to accommodate important rush orders. Higher rates must often be paid the new men, and this also adds to the production cost. When the costs have once increased, it is a difficult matter to bring them back again to the old level.

While it is true that rush orders interfere with regular production and should not be encouraged, there are times when they must be accepted to accommodate important customers. Although orders of this kind do not ordinarily show much profit, such accommodations must nevertheless be made in the interest of future business. Orders of this kind often give the company an opportunity to expand its business.

MORTON SCHWAM

Airplane Welding Done in Jigs

Interchangeability Secured and Production Increased by the Use of Jigs in Welding the Framework of Fairchild Airplanes

By CHARLES O. HERB

MAXIMUM strength and rigidity, combined with minimum weight, are the objectives of the airplane designer. With a view to obtaining these qualities, the Fairchild Airplane Mfg. Corporation, Farmingdale, Long Island, N. Y., uses chrome-molybdenum steel tubing almost exclusively in constructing the framework of fuselages, ailerons, stabilizers, elevators, and rudders. The pieces of tubing are welded securely together by the use of the oxy-acetylene process.

An interesting feature of the welding practice followed in this plant is the use of jigs, built up of structural steel, which are employed during the welding operations to hold the pieces of tubing accurately in position while they are being joined. These jigs have made it unnecessary to fit the pieces of tubing to suit each individual job, and as a result, tubes of given lengths can be cut in quantities for a number of airplanes. This reduces the welding time per unit considerably and consequently increases the rate of production. Uniformity in the dimensions of the airplane sections is also insured by the jigs, so that the sections are interchangeable on airplanes of any one model. Typical examples of these jigs are shown in the illustrations.

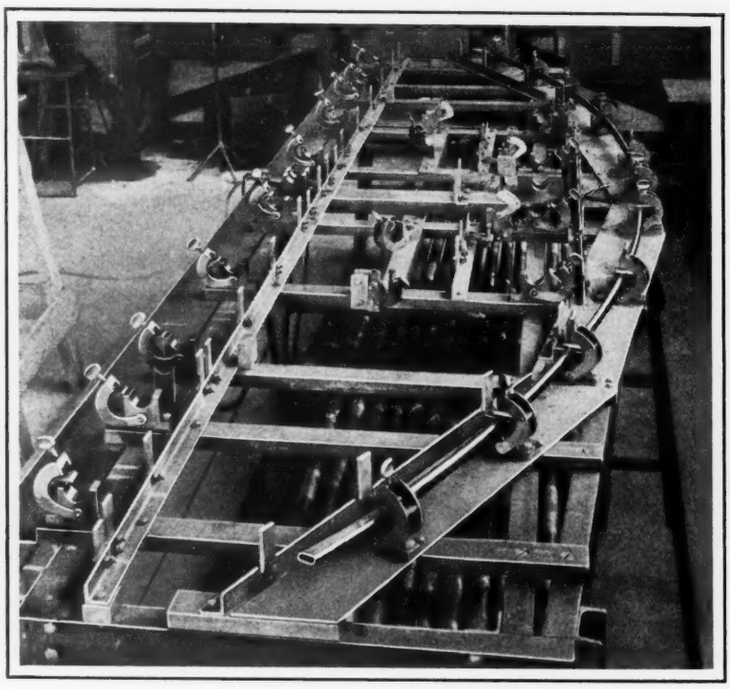


Fig. 1. Jig that has Enabled the Welding of Stabilizers for Airplanes to be Standardized

Quick-acting Clamps Hold the Tubes in Place

Fig. 1 shows the construction of a jig used in tack-welding together the various tubes of stabilizers preliminary to placing the unit in a second jig, designed to prevent the stabilizers from warping during the welding process. In the final welding, it is the practice to start at the middle of the stabilizer and weld joints alternately from right to left until the work is completed. Thirty or more clamps of

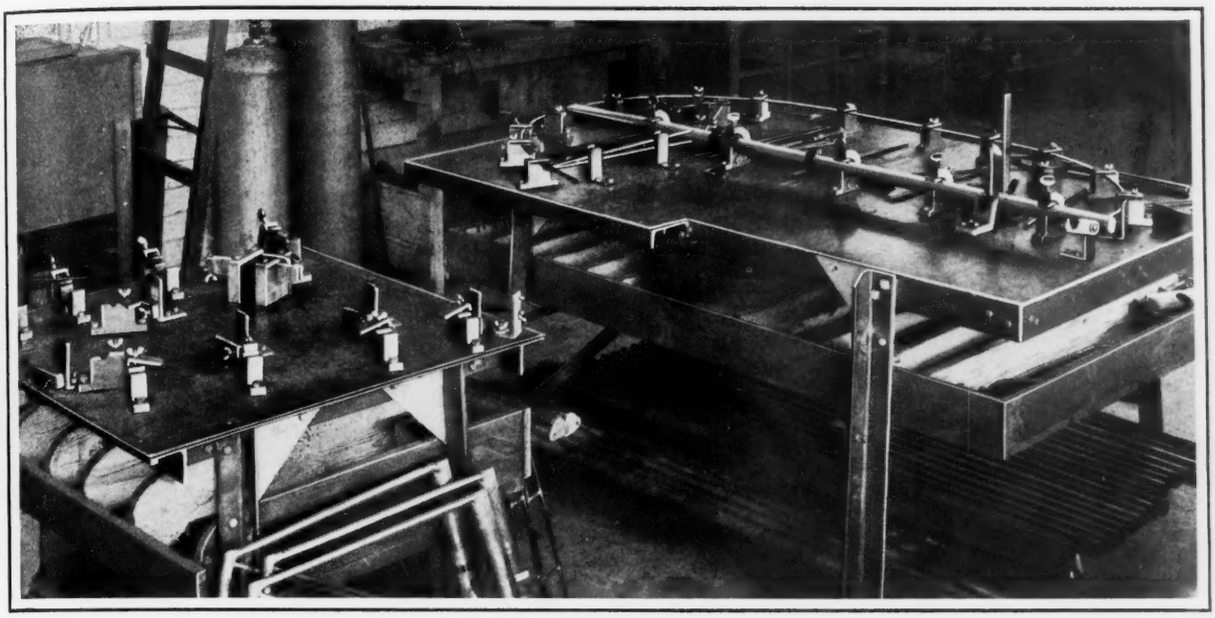


Fig. 2. Two Simple Jig Designs Used in Constructing Rudders and Fins

a quick-acting design are provided on the jig illustrated in Fig. 1 for holding the various tube members at the proper radius and angles. These clamps are made with a hollowed-out seat into which the tubes fit.

Fig. 2 shows two more simple jigs; the one at the right is used in constructing the rudders, and the one at the left is employed in building up the fins.

Turn-over Jigs Facilitate Welding on Both Sides of Ailerons

In the foreground of Fig. 3, may be seen two jigs that can be revolved on horizontal axes in order to weld ailerons on both sides. Before the welding is started, tubes of specified lengths are located along the jigs and firmly gripped by the different clamps. The operation of welding is started at the narrow end of the ailerons so as to avoid welding the tubes while they are expanded and under tension. The practice is to weld two joints all around by swiveling the jig before welding on the next two joints is started.

Tubes of different lengths are kept in compartments in the large tray seen beneath each jig, and the length of tubes contained is prominently marked on each compartment. Also, at the points where the tubes are clamped in the jigs, the required lengths are clearly designated for the convenience of the welders in loading the jigs.

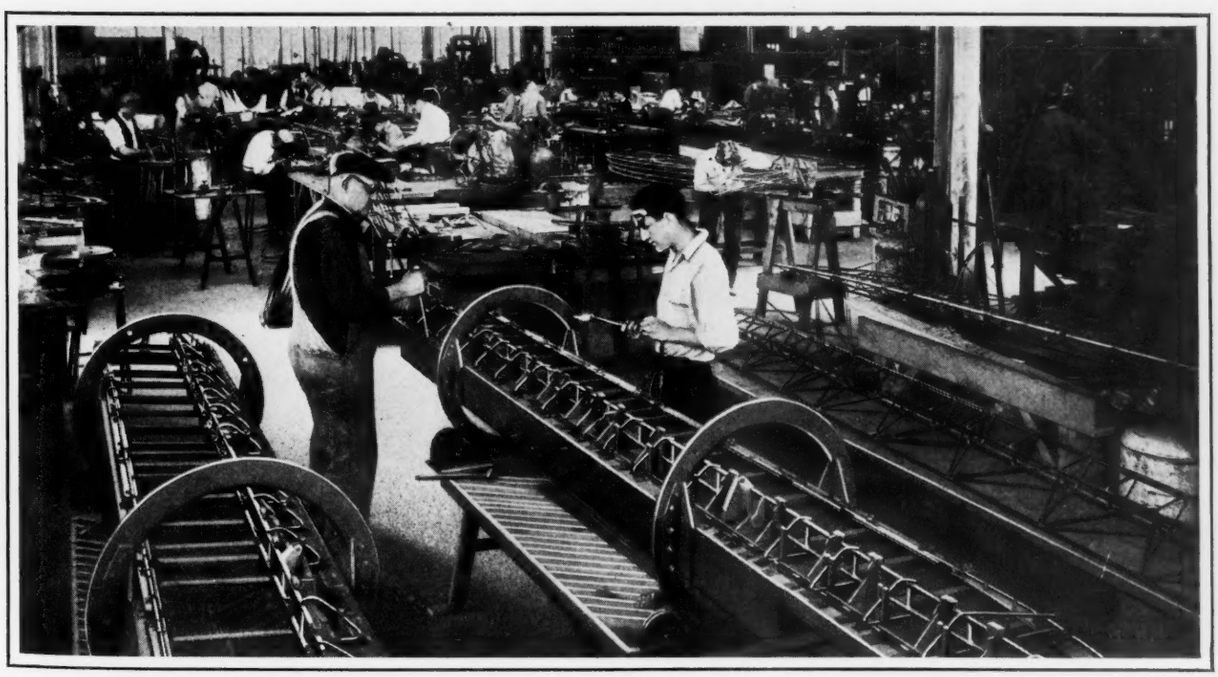


Fig. 3. General View of Welding Department with Aileron Jigs of Revolving Type in Foreground

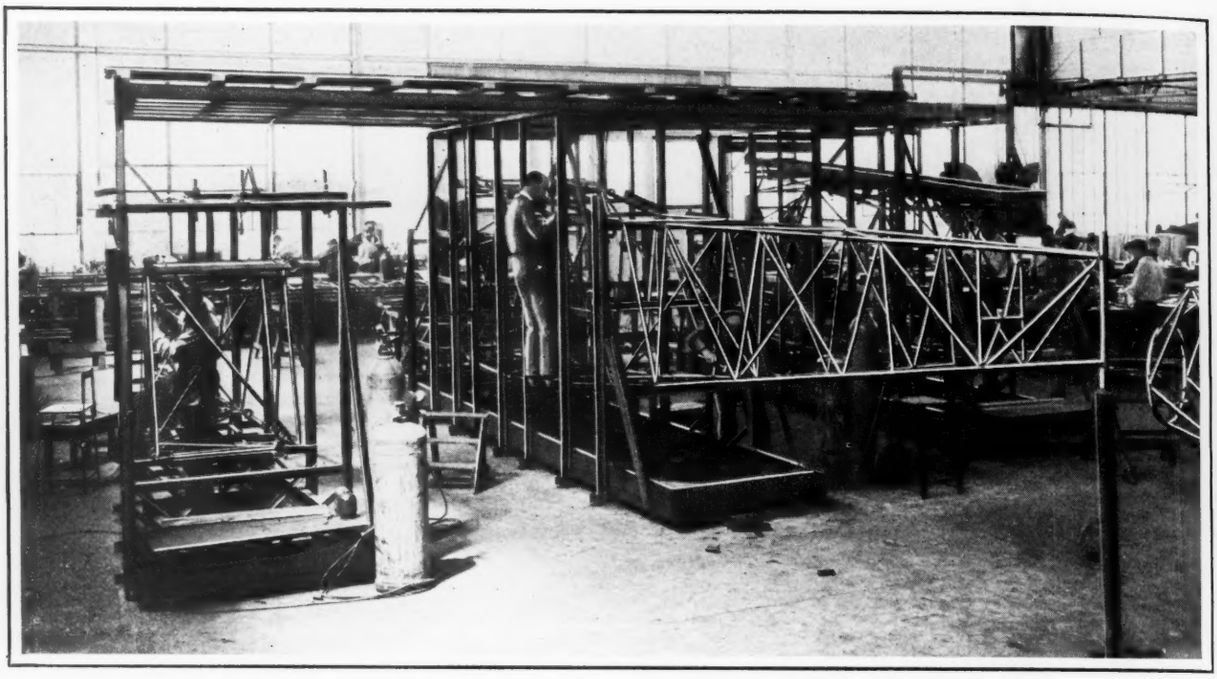


Fig. 4. Three Men Using Jigs of the Type Here Shown can Weld a Fuselage Complete in a Nine-hour Day

Fuselage Jigs Permit Freedom in Welding

Fuselages are built up in two sections and then assembled together. Fig. 4 shows three jigs, two of which are used in welding the cabin part of fuselages, and the third in welding the tail-piece. The tail-pieces can be produced more quickly than the cabin portion, and so a tail-piece is usually assembled to a cabin section before the latter is removed from the jig.

The construction of the fuselage jigs is such that the welders have convenient access to all joints to be welded from above, beneath, or within the fuselage. Several welders can work on one fuselage at a time, and three men can turn out a complete fuselage in a nine-hour day.

Templets Used to Cut Tubes to Length

Tubes are cut to length by means of a high-speed circular saw of small diameter, templets being used to insure correct length and the tubes being firmly gripped in air-operated clamps during the sawing-off process. Quite a few tubes must be provided with fish-mouth ends for joints, such as illustrated by the two examples in Fig. 5. These fish-mouth ends are also cut to templets. Tubes ranging from 1/4 inch up to 2 1/2 inches outside diameter are used in building Fairchild airplanes; the smaller tubes have a wall thickness of approximately 1/32 inch.

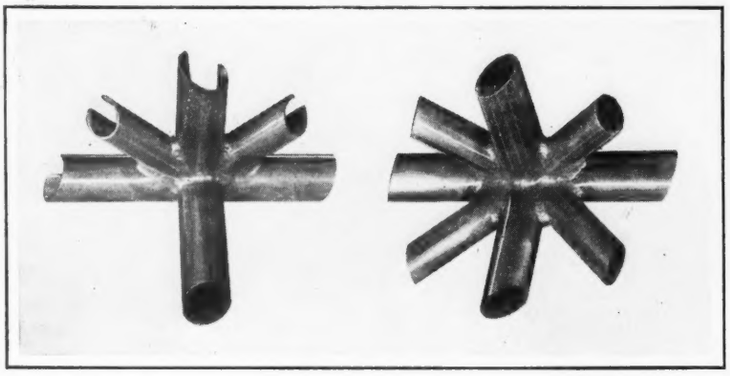


Fig. 5. Two Examples of Welding Required in Airplane Construction

Expert Welders Required for Airplane Work

If the engine of an airplane ceases to function during a flight, the aviator has the opportunity of gliding to safety, but the failure of a welded strut may prove disastrous. For this reason, only expert welders should be employed in constructing the framework of airplanes. All welders in the plant of the Fairchild Co. must serve a long training period on the bench, working on minor parts before they are assigned to welding the main fittings.

Oil Tests Guard Against Faulty Welding

Wherever fuselage tubes become closed at the joints by welding, a 1/8-inch hole is drilled through the wall of welded metal, so that when the assembly has been completed, all tubes of the entire fuselage may be filled with linseed oil to detect faulty welds and give a rustproof coating to the inside of the tubes. With the fuselage held as shown in Fig. 6, the oil, heated to 180 degrees F., is pumped through plugs at the upper end until all the tubes are filled. By placing his hand on each tube to see if it is hot, the inspector can determine whether or not every tube has become filled. Faulty welding will be revealed by oil leaking through the tubes. When the test has been completed, a plug at the tail end of the fuselage is removed to let the removed in order to let the oil drain off.

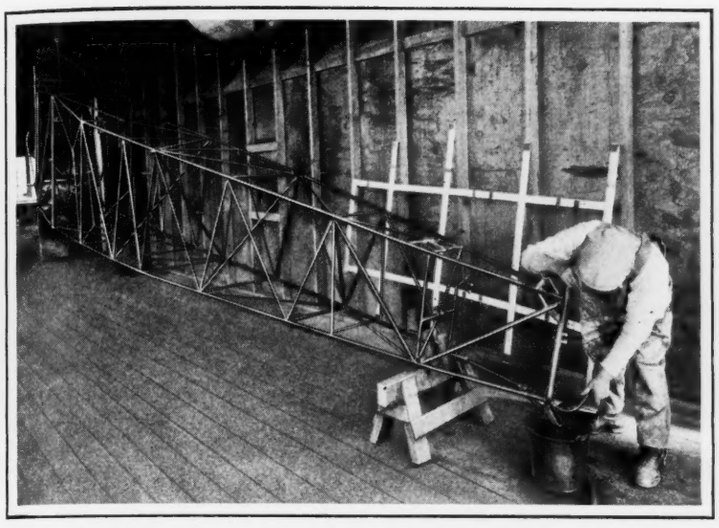


Fig. 6. Each Fuselage Framework is Pumped Full of Linseed Oil to Detect Faulty Welding and to Give the Interior a Rustproof Coating

After an airplane has been placed in service, oil can be fed periodically in a similar manner through all the fuselage tubes, in order to guard against corrosion of the inside of the tubes. The tubes are protected on the outside by two coats of aluminum enamel, which are applied after the framework has been thoroughly sand-blasted and cleaned.

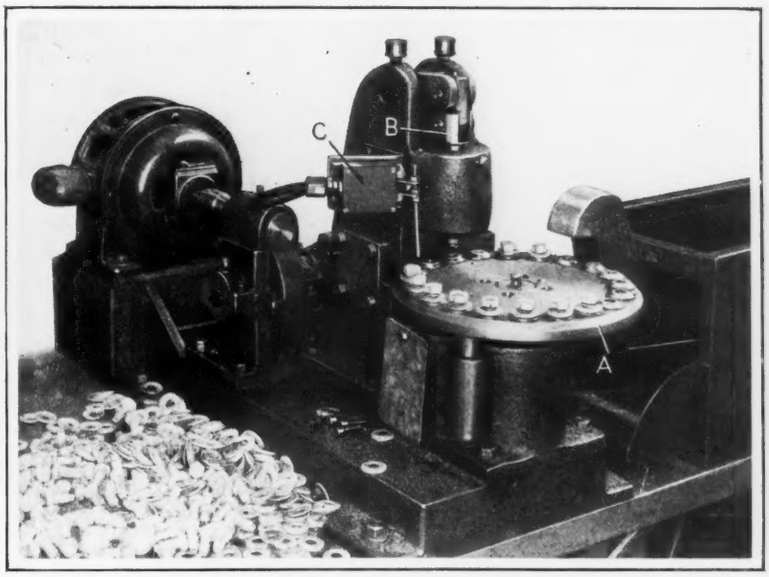
* * *

PRESSING WASHERS ON BOLTS AT HIGH SPEED

Large savings can often be effected by providing automatic equipment for performing the simplest sort of operations. Such an example is presented in the accompanying illustration, which shows a small machine developed in the Plymouth automobile plant of the Chrysler Corporation, Detroit, Mich., for pressing washers to a tight fit on 3/8-inch bolts. The washers have a series of serrations around the hole and are forced with a tight fit on a narrow shoulder just beneath the head of the bolts.

The operator of the machine, usually a girl, slips the washers loosely on the shanks of the bolts and places the bolts in bushings arranged around index-plate *A*, with the heads uppermost. This plate carries each bolt and washer successively beneath the punch attached to ram *B* of the machine. As the parts reach this position, plate *A* pauses just long enough for the punch to force the bolt firmly into the washer at the down stroke of the ram. On the right-hand side of the machine, there is a vertical plunger which enters the bushings from the bottom to eject the assembled parts. These slide down an inclined chute into the sheet-steel box shown at the right in the illustration.

Table *A* indexes once every second or 3600 times an hour. The power for driving the machine is supplied by a 3/4-horsepower motor running at 1800 revolutions per minute, which drives through a worm-gear speed reducer to a crankshaft that operates the press ram. The crankshaft also actuates a ratchet mechanism for indexing the table and drives the work-ejecting device. Safety device *C* stops the machine in case two washers are accidentally slipped on a bolt and placed in a bushing in the index-plate.



Simple Automatic Machine which Forces Washers on Bolts at High Rates of Production

* * *

MACHINERY INDUSTRY IS ONLY PARTLY ORGANIZED

At a meeting of representatives of associations in the machinery industries recently held in Washington, it was stated that there are approximately 10,000 machinery manufacturers in the United States. Only about 1000 of these manufacturers are members of trade organizations that directly or indirectly relate to some phase of the machinery industry, there being in all about forty such trade associations. From this it will be seen that about nine-tenths of the manufacturers in the machinery field are not organized and do not belong to any association specifically identified with their line of manufacture.

* * *

In heavy-duty vehicles, the failure of babbitt-lined bearings is one of the most frequent causes for the removal of the engine from its chassis, according to E. J. Hall of the Hall-Scott Motor Car Co. After much experimenting, this company has adopted a copper-lead bearing which is cast by the centrifugal method and is composed of 25 per cent lead and 75 per cent copper. It is claimed that these bearings will give 100,000 to 150,000 miles of inter-city coach service without attention.

Time Required for the Action of a Spring

Formulas for Calculating the Time Required for a Spring to Perform its Allotted Function, and Examples Illustrating Application

By J. S. BEGGS

IN designing high-speed machinery, it is often desirable to know quite accurately the time consumed by a spring in moving a certain part a given distance. The formula presented in this article was evolved to enable the time required for a spring to act under certain conditions to be computed quickly. The formula has been found to give results that agree very closely with those obtained by the oscillograph; it is based on a theory believed to be correct, but the derivation of the formula is too lengthy and complicated for publication in the columns of MACHINERY.

Referring to the condition shown diagrammatically in Fig. 1, we have,

W = weight of body to be moved, in pounds;

T_1 = initial tension of spring T, in pounds exerted on body;

T_2 = final tension of spring T, in pounds exerted on body;

d = distance which the body is moved, in inches;

a = angle, the sine of which is $\sqrt{\frac{T_1 - T_2}{2T_1}}$, expressed in degrees; and

t = time, in seconds, required to move weight W a distance d.

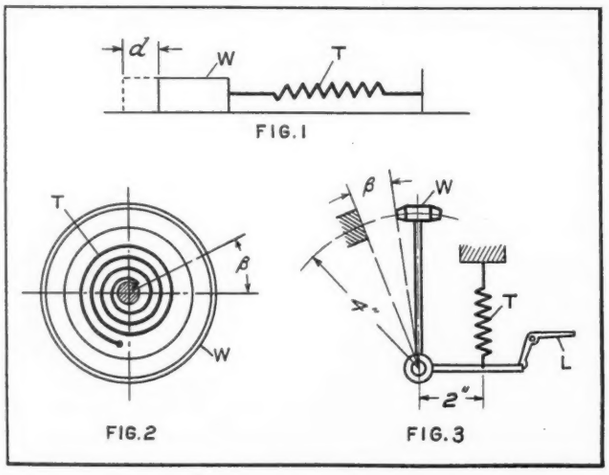


Fig. 1. Diagram Showing Spring T Arranged to Move Weight W a Distance d. Fig. 2. Arrangement of Spiral Spring T for Imparting an Angular Movement β to Wheel W. Fig. 3. Hammer W Actuated by Spring T when Latch L is Tripped

The tension, in pounds, required to overcome friction should be determined or closely estimated whenever possible and subtracted from each of the tension values T_1 and T_2. If the weight of the spring is appreciable, one-third of its weight should be added to the weight W of the body. The time t, in seconds, required to move the weight W a distance d is found by the formula,

$$t = 0.001776 \sqrt{\frac{Wd}{T_1 - T_2}} \times a$$

The angle a should be expressed in degrees and decimals of a degree. For example, an angle of 20 degrees 42 minutes equals 20.7 degrees.

When the spring imparts circular motion, as in the case illustrated diagrammatically in Fig. 2, a similar formula is employed in which the following notation is used:

W = weight of body, in pounds;

K = radius of gyration about axis of rotation, in inches;

β = angle through which body is turned, in degrees;

T_1 = initial torque of spring T on body, in inch-pounds;

T_2 = final torque of spring on body, in inch-pounds;

a = angle, the sine of which is $\sqrt{\frac{T_1 - T_2}{2T_1}}$, expressed in degrees; and

t = time, in seconds, required to move weight W through the given angle β.

For circular motion we have,

$$t = 0.0002346 \times \sqrt{\frac{\beta \times WK^2}{T_1 - T_2}} \times a$$

As an example, let us find the time consumed by the spring T, Fig. 3, in moving hammer W through the angle β, while delivering its blow to the anvil shown in cross-section. In this case, the inertia of the arm may be neglected. By tests it is determined that the initial tension exerted on the arm by spring T is 20 pounds and that the final tension after the arm has been revolved through an angle of 11 degrees is 15 pounds. As the force exerted by the spring is applied at a distance of 2 inches from the center of the axis of rotation, we have $T_1 = 20 \times 2$ and $T_2 = 15 \times 2$. Thus: $W = 1$ pound; $T_1 = 40$; $T_2 = 30$; $\beta = 11$ degrees; and $K = 4$ inches.

Substituting the known numerical values:

$$t = 0.0002346 \sqrt{\frac{11 \times 1 \times 4^2}{40 - 30}} \times a$$

$$\text{Sin } a = \sqrt{\frac{40 - 30}{2 \times 40}} = 0.354$$

The angle whose sine is 0.354 is 20 degrees 44 minutes, or 20.73 degrees. Then,

$t = 0.0002346 \sqrt{17.60} \times 20.73 = 0.020$ second

Machining Couplings on a Production Basis

Special Tools Applied to Turret Lathe and Drilling Machine, Designed to Insure Interchangeability and Increase Production

By JOSEPH E. FENNO

THE tools here described were designed for machining the coupling member shown in Fig 1. This coupling is a component part of a bread-wrapping machine. The operations and tools are described in their proper sequence.

First Turret Lathe Operation

In the first operation, the coupling is gripped in a three-jawed chuck equipped with special jaws *E*, as shown in Fig. 2. The jaws are so formed that they act as a stop for locating the work. The large bore is roughed out with a standard boring tool, which is so ground that it also serves to rough-face

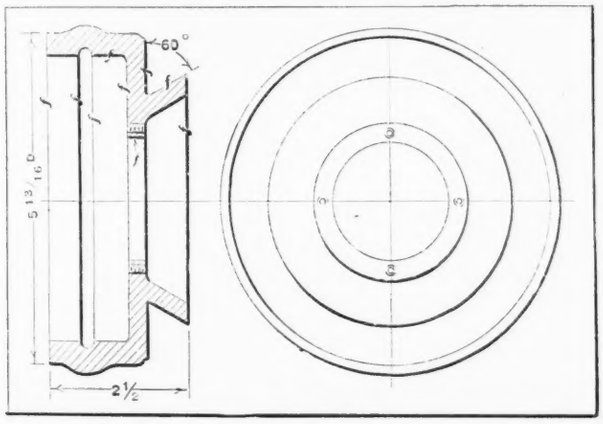


Fig. 1. Cast-iron Coupling Member

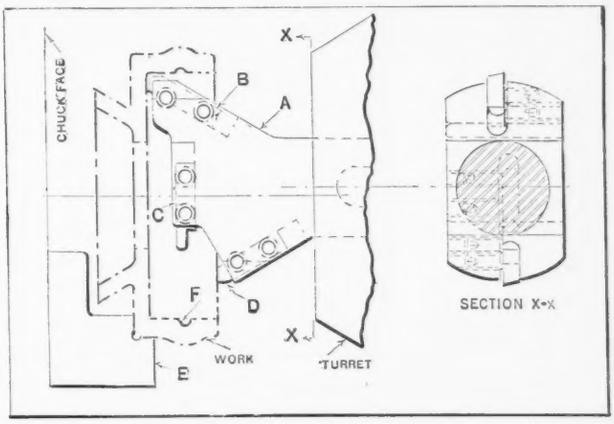


Fig. 2. First Turret Lathe Operation

the outside face and the bottom of the bore. The finish cuts are made with the multiple tool shown at *A*.

The cutter *B* which is set by means of the cross-feed graduations to semi-finish the bore, is brought into operation first. The depth of this cut is governed by the carriage stop. When the cutter reaches the required depth, the cross-feed is thrown in, causing the cutter *B* to finish-face the bottom of the bore and the cutter *D* to face the outside. When cutter *D* has passed the edge of the coupling, the cross-feed is disengaged and the tool *C* fed in by hand to form the semi-circular shaped groove *F*. A piloted reamer type of tool (not shown) is used to accurately size the bore.

Second Turret Lathe Operation

The second operation, that of turning and rough-facing the opposite side, is accomplished with the tools shown in Fig. 3. The coupling is held in the faceplate fixture *A*. As great accuracy is required regarding the concentricity of both sides of the coupling member, special means were provided for centering it upon the fixture. The flange or rabbet *B*, which is machined solid with the body of the fixture, serves to center the work accurately.

The coupling is held securely by the split steel ring *F*, the tapered bore of which slides on the member *E*, which causes it to expand and grip the work. The gripping action also tends to force the work inward against the fixture. The work is clamped by the nut *D*, which acts against the dish-shaped plate *G*, thus setting up a pressure against the split ring. A socket wrench is used for operating the nut *D*. Three shoulder screws *R*, which are sliding fits in the body *A*, serve to prevent the clamping members from coming apart in case nut *D* is unscrewed too far. This construction provides the necessary floating action.

The coupling is first rough-faced on the outside and bottom with a double-cutter tool (not shown) and rough-bored with a standard tool. The taper is then followed out with a scaling tool, after which a slabbing tool, set at the proper angle, turns the work to within 0.015 inch of the finished size. The finish-facing is done with a tool similar to that used for roughing, and the finish-boring is done with a standard tool.

The taper is finished with the tooling arrangement shown. The member *C* is centered with the turret station bore by the plug *P*, and is fastened securely to the turret by the collar-nut *Q* or stud *O*, which passes through the opposite station of the turret. Member *C* is prevented from turning by the dowel *N*, which is a slip fit in a hole drilled in the turret. The part *J* slides on member *C*, a gib being provided to take up lost motion.

Cast integral with the slide *J* is an arm which carries a hardened steel roller *H*. This roller rides against the angle-bar *S*, which is set to generate the required taper on the work. The angle-bar is

pivoted by a shoulder screw in the block *Z*, and is located by the indexing pin *W*, which enters bushings in both the angle-bar and the block. The angle-bar is fastened in position by the hexagonal-head screw *V*. The block is fastened to the cut-off slide by the sunken-head screws *U* in the T-slot *T*. The roller *H* is held against the angle-bar by means of the spring *K*, which acts against the projecting lugs of both members *C* and *J*. The length of the travel of slide *J* is limited by the adjustment of nuts *M* on the stop-rod *L* which passes through the coil spring and is screwed tightly into the lug of the slide.

The bar *I* is a slip fit in the hub of slide *J*, and is fastened by two hollow-head set-screws. The tool bits are also secured by hollow-head set-screws. The action of the tool is easily understood. When the carriage is moved forward, the roller, coming into contact with the angle-bar, moves the slide *J* inward the amount required to machine the taper on the coupling. A "Go" and "Not Go" gage, such as shown in the lower left-hand corner of Fig. 3, is employed for checking the taper. It will be noted that bushings are provided for an extra indexing position for the angle-bar. This was done to suit a similar couping which had a different taper. By having a number of interchangeable bars *I*, a wide range of tapers can be machined.

Drilling and Tapping Operation

The tools shown in Fig. 4 are used for drilling the coupling, which is centered on the rabbet of the fixture *K*. This fixture is secured to an upright drill table, the drilling spindles operating in a vertical position instead of in the horizontal position shown in the illustration. The drilling is done with a special combination multiple drilling head *C*, the drills being guided by the bushing plate *H*.

The head is fastened to the machine spindle sleeve at *N* by the member *A*, which is detachable from the head at *E*. The member *A* is also used for holding several other heads of similar design employed for different pieces of work. The taper shank *B*, which fits the machine spindle, drives the four spindles of the head. The head gearing is not described, as it is of regular design.

The end of the drill bushing plate *H* is a slip fit in the sleeve-like projection *I* on the head cover. The screw *F* serves as a stop for the bushing plate when the machine spindle is raised, while the spring *G* provides the required amount of pressure to keep the lower end of the plate *H* solidly in contact with the boss *R* during the drilling operation.

Plug *J*, which is driven into the fixture *K*, is a slide fit in the bushing plate and acts as a guide for locating the bushing plate in a central position with respect to the coupling. The combination head and

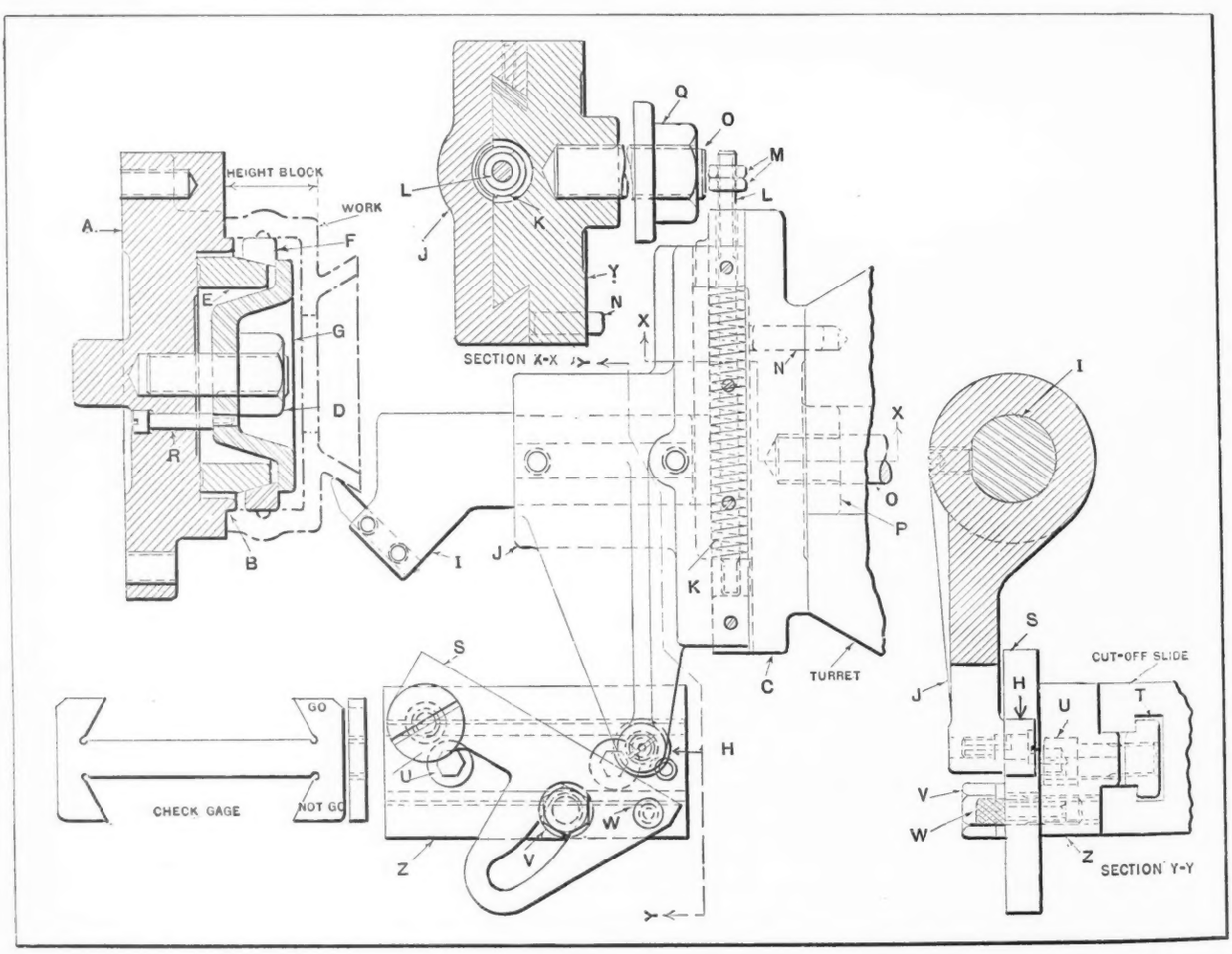


Fig. 3. Turret Lathe Set-up for Second Operation on Coupling

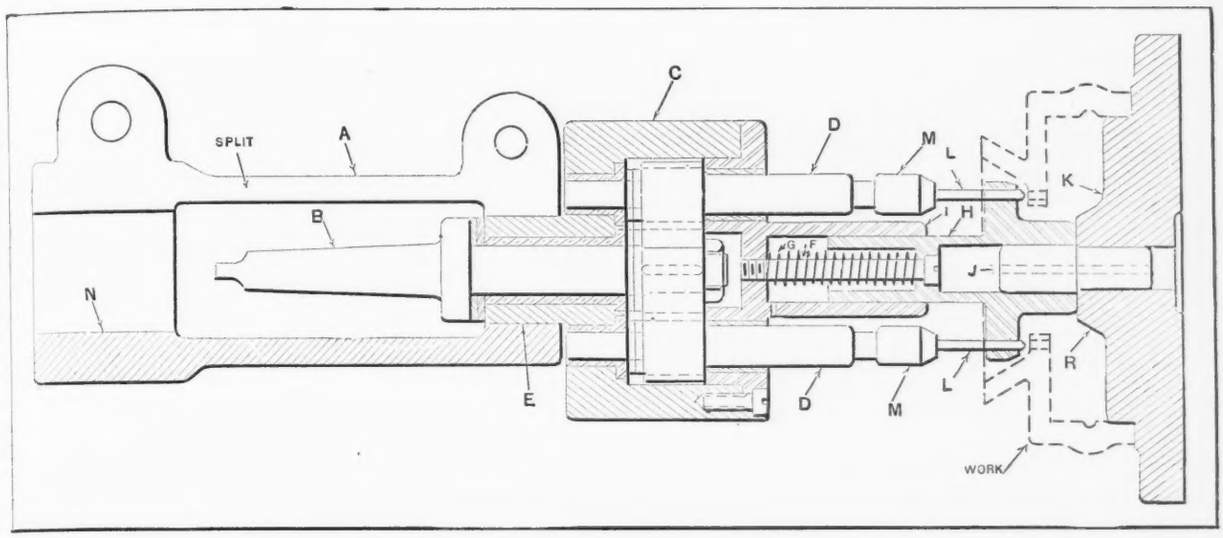


Fig. 4. Drilling Attachment Used on Vertical-spindle Drilling Machine

bushing plate permits rapid loading and unloading of the work, as the bushing plate is removed with the head each time the machine is raised. The complete lot of coupling members is first drilled, after which the couplings are tapped with the same tool equipment, except that plate *H* is removed and the machine reversing gear applied. The tools described are in successful operation, meeting high-production requirements.

* * *

ALUMINUM BRONZE

The possible applications of aluminum bronze and the reasons why it is not more commonly employed are discussed in a publication recently issued by the British Aluminum Co., Ltd. In its simplest form, this alloy comprises 90 per cent copper and 10 per cent aluminum. This composition possesses much the same properties as Swedish Bessemer steel and has a tensile strength of over 60,000 pounds per square inch, with an elongation of 25 per cent. Its susceptibility to heat-treatment within the same range as steel, and with similar results, makes it unique among bronzes.

A variation of from 5 to 11 per cent in the aluminum content, or the adding of small percentages of other metals, such as iron, nickel, manganese, and lead, adds valuable physical or foundry properties. The alloy is available in both cast or worked forms, with physical properties varying all the way from an elongation of 78 per cent, with a relatively low yield point and tensile strength, to a Brinell hardness of 260, with comparatively low ductility and a high elastic limit. All the alloys are highly resistant to acid attack and to oxidation at red heat, and possess great resistance to shock and prolonged fatigue stresses.

To eliminate defects in castings, certain precautions must be taken. The whitish patches of aluminum oxide formed during the alloying process may be eliminated by the use of electrolytic or deoxidized copper. Pin holes which may be present in the casting are largely due to the tendency of both aluminum and copper to absorb gases. The absorption of gases may be minimized by using as low a temperature as possible when melting, by avoiding splashing, and by pouring as soon as possible after melting. Shots or folds in the casting are attributed to the rapid oxidation of the aluminum while molten. This is eliminated to some degree by the use of gates to prevent splashing of the metal. Neglect of this precaution results in individual globules of metal receiving a coating of oxide which may prevent reunion with the main body of the casting.

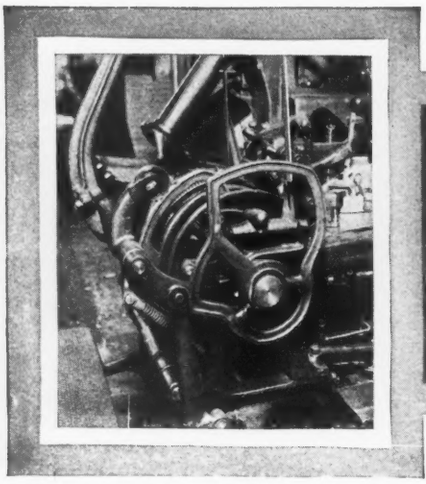
The high shrinkage of these castings necessitates suitably placed risers to prevent the forming of large internal cavities or draws. The danger of this defect is accentuated by the extremely small range of temperature between the liquid and solid states of the alloy, resulting in abrupt transition to the solid state.

In die-casting aluminum bronze, several points should be observed. When possible, flat objects should be cast flat and not on edge, thus reducing unsightly runner marks. The gate should be central to avoid the flow of hot metal over a restricted area of the mold for an unnecessarily long period. Also, the gate should be located so that thin sections of the mold will fill first while the metal is at its highest heat.

It will thus be apparent that the treatment necessary to secure success in the case of aluminum bronze castings differs somewhat from that followed for other alloys; but as the reasons for the difficulties experienced are now more fully understood, a rapid growth in the practical application of this alloy may safely be predicted.

* * *

Young men say there are no opportunities. Why, the world's opportunities are only beginning to break. Every generation leaves more opportunities than it found. Compared with today the opportunities of fifty years ago were startlingly few.—*Henry Ford* in *Forbes Magazine.*



Ingenious Mechanical Movements

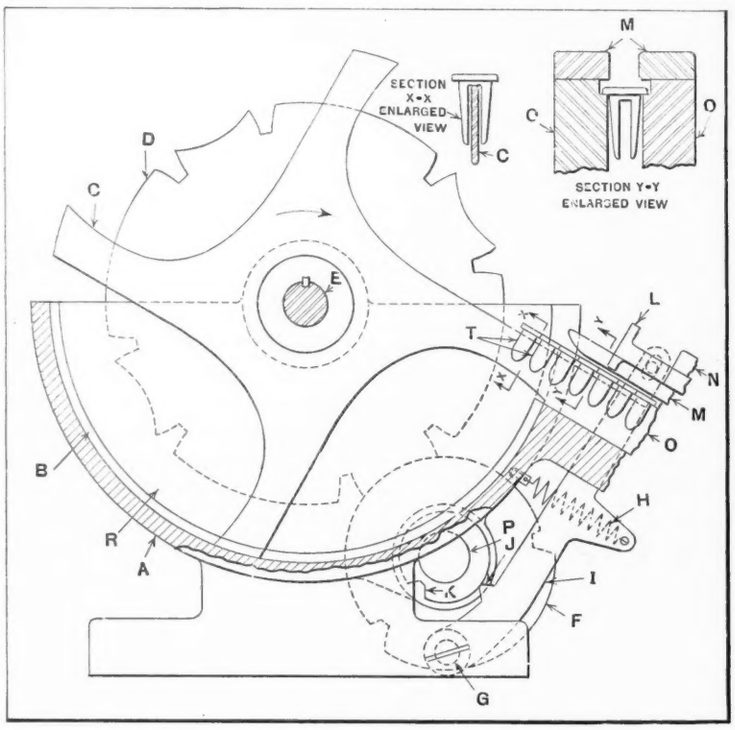
FEEDING SPLIT RIVETS TO POWER PRESS

By F. E. JUDSON

The automatic feeding mechanism here illustrated is used for feeding split brass rivets to a dial on a power press, where they are assembled into porcelain fuse plugs. The hopper *A*, fastened to a bracket on the press in a position above the dial, is equipped with the four-bladed member *C*. For each revolution, member *C* is given an intermittent motion including four equally spaced dwells, through the action of the gears *D* and *F* keyed to shafts *E* and *P*, respectively. Shaft *P* is the driving member for the hopper, and receives its motion through a chain drive connected to the press crankshaft.

The rivets are placed in the reservoir *R*, and as member *C* revolves in the direction of the arrow, some of them will straddle the blades, as shown in the cross-sectional view *x–x*. As the member *C* continues to revolve, the rivets slide along the curved edge of the blade until they arrive at the position shown at *T*. Each blade dwells long enough at this point to permit the rivets to slide off and into the chute *O*. To facilitate the delivery of the rivets to the chute, the latter was constructed to support the rivets under their heads (see section *y–y*), the strips *M* acting as a guard to prevent them from piling up on each other on the incline.

The top of the chute is kept clear of incorrectly delivered rivets by the sliding finger *L*. This finger receives its motion from the lever *I*, pivoted at *G*, and is actuated by the revolving cam *K* which engages the lug *J*. The spring *H* carries the finger toward the hopper, while the outward movement is positive. The plate *N* serves as a gib for the sliding finger *L*.



Rotary Hopper for Feeding Split Rivets to a Dial Press

* * *

HIGH SPEED INTERMITTENT ROTARY MOTION

By RALPH A. GLEASON

The mechanism shown in the accompanying illustration provides the intermittent rotary motion required for operating the conveyor of a wire stitcher. The member *A* receives its intermittent rotary motion from the continuously rotating shaft *B* through the positive indexing action of an eccentric strap *C* operated by the eccentric *L* keyed to shaft *B*. A sprocket or gear—not shown—attached to the hob or face of member *A* transmits the intermittent motion to the conveyor.

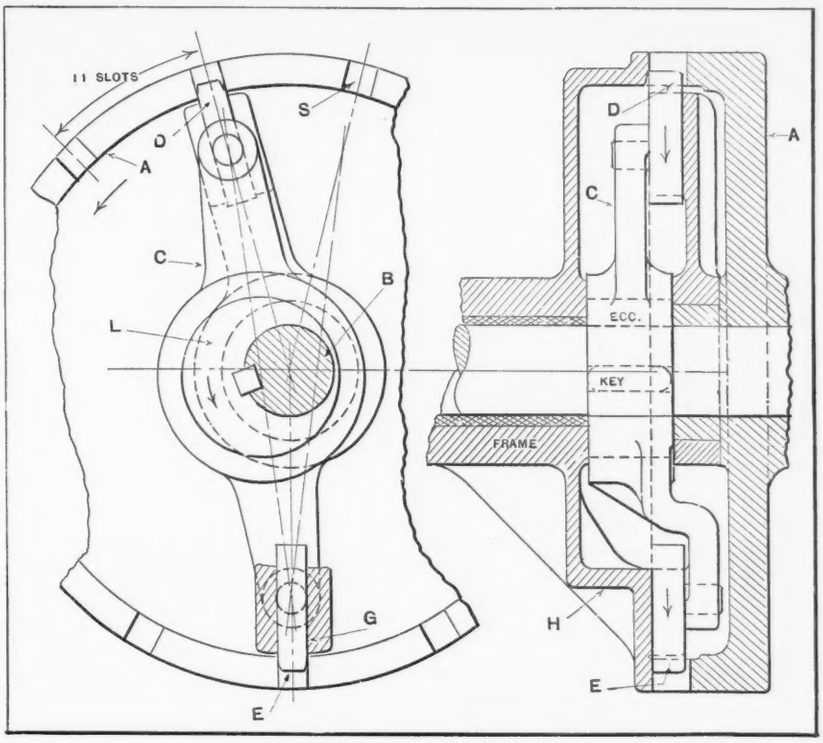
At each revolution of shaft *B* the member *A* is indexed 1/11 revolution by pin *D* which engages one of the eleven evenly spaced slots *S*. During the idle or return movement of pin *D*, the member *A* is locked in position by pin *E*. The ratio of the idle time between the indexing movements, to the indexing time, is 73 to 107 in the design illustrated.

At the beginning of the indexing

movement, member *A* moves slowly, but the speed increases rapidly to the maximum and then slows down as the end of the movement is reached. As the mechanism stops the load slowly and without shock, it can be operated at high speeds, as compared with the usual ratchet wheel and pawl mechanism, which is difficult to balance and has a tendency to "overthrow" under appreciable loads.

The member *A* is always engaged by one or both of the actuating teeth *D* and *E*. These teeth are pivoted to the extreme opposite ends of the eccentric strap *C*. Overthrow is prevented by the locking tooth *E*, which is a free sliding fit in the groove *G* machined in the frame *H*. This slot restricts the movement of the pivoted tooth *E* so that it is forced to travel in a vertical direction.

The view at the left in the accompanying illustration shows the parts of the mechanism in the positions they occupy at the completion of the indexing movement. It will be noticed that the tooth *E* has entered one of the slots in member *A* before tooth *D* has become disengaged from another slot of the member.



Intermittent Rotary Motion Mechanism

The peculiar motion imparted to the eccentric strap *C* by the eccentric *L*, due to the vertical path which its lower end is forced to follow, causes the top end of the strap to move in an elliptical path, carrying with it the actuating tooth *D*. Tooth *D* is always held in a radial position by a slot in the guiding arm, which is a free fit on the hub of member *A*. The elliptical motion and the radial guide force the actuating tooth *D* to engage and disengage successively the slots in the edge of member *A*, thus converting constant rotary motion into a positive intermittent motion.

The mechanism is equally efficient when operated in either direction. In adapting it for other purposes, the following characteristics should be considered: The slot spacing in member *A* controls the amount of intermittent motion and also the idle time. There must be an odd number of slots if the best action is to be obtained, but as a gear or sprocket drive of the proper ratio can be used to suit individual requirements, this characteristic is not a vital fault.

If too few slots are used, the eccentric throw will be excessive and the action of the mechanism will not be so smooth as with a greater number of slots. It is well to bear in mind that fewer slots decrease and more slots increase the idle time.

The interior of the mechanism shown is filled with grease, but the flanged parts of the frame could be fitted with a cover and a packing ring could be provided on the hub of member *A* so that the mechanism could be filled with oil. With this form of lubrication, the carrying power would be increased to handle greater loads at higher speeds.

* * *

A good boss knows how to develop men and get the most out of them, and a man is never so happy as when he is working at his full capacity. To do good work and to receive recognition for it satisfies the soul as completely as any human experience. Happy men are well employed men. But, of those who are expected to do so, not more than one in three is fit to boss others. The majority are getting only half of what they could out of their subordinates because they do not understand human nature. They can frighten and irritate, but they cannot teach and stimulate. They give to those under them no sense of understanding or appreciation.

The intelligent boss knows that a man who is intelligently directed and encouraged is worth two men who have had all sense of cooperation knocked out of them. Most of us dislike avoidable waste. Here is a waste that transcends all others. It cannot be stopped until the big bosses choose the little bosses more carefully, or until all bosses are taught the economics of bossing. Enlightened bossing opens up an opportunity for a golden stream of profits.—*The William Feather Magazine.*

* * *

For quenching purposes, mineral oil should be avoided. According to Houghton's *Black & White*, these oils vary in heat absorption and dissipation at varying temperatures of the oil bath. A further objection is that the consumption of oil per ton of steel quenched is greater than with other quenching media.

Tooling for Production Turning

Special Tool and Chuck Equipment for Turning Operations on Lathe with Front and Rear Cross-slides

By FRANK H. MAYOH

THE tools and chucks described and illustrated in this article are employed for production turning operations on a Lodge & Shipley Duomatic. Although designed for use on this particular machine, which has independently operated front and rear cross-slides, the equipment embodies various features that are applicable to chucks and turning tools in general, and that are by no means confined to one type of machine.

Tools for Machining Grooves in Conical Part

In Fig. 1 is shown a conical shaped part mounted on an expanding collet type of chuck. The grooves in this part were cut by the cutters held in the two tool-blocks mounted on the front and rear cross-slides. It will be noted that the set-screws which hold the cutters in place are staggered in order to give clearance space for a socket wrench, and that each cutter is backed up by a headless adjusting screw. When the machine is to be set up for another job, the tool-blocks are removed as independent units without disturbing the setting of the cutters.

Machining a Cluster Gear in 1 1/4 Minutes

The turning and facing operations on the cluster gear blank shown in Fig. 2 are accomplished in 1 1/4 minutes. The tools held in the special rear slide perform the facing operations. In addition to facing, the second tool from the right also turns the tapered surface at the left of the flange. The two tools held in the separate block at the left on the rear slide likewise perform facing and turning operations. These tools are all fed inward toward the front of the lathe. The four tools held in the tool-block mounted on the front cross-slide turn the outside diameters of the gear blank. For the turning operations on these surfaces, the tool-block is fed toward the left, the traversing movement being parallel with the axis of the work.

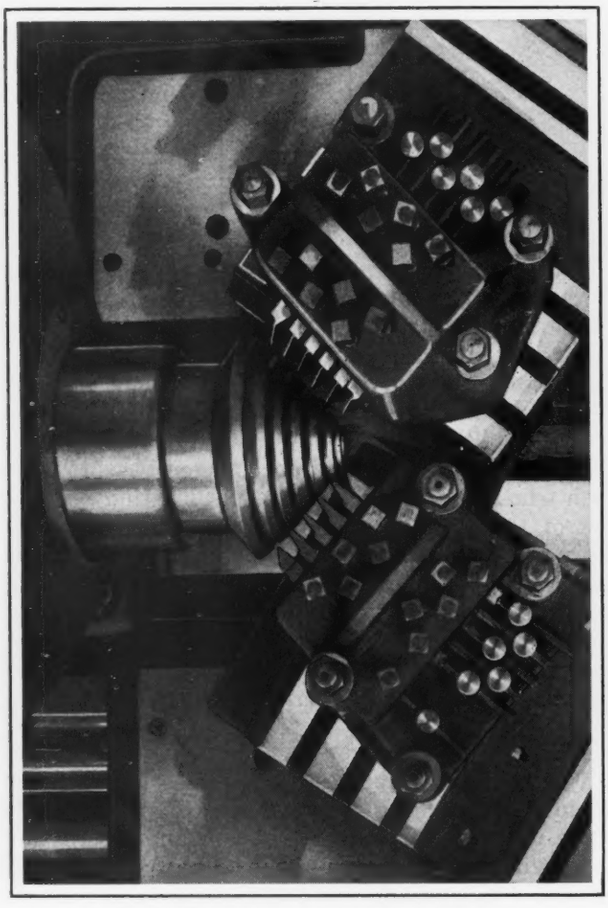


Fig. 1. Special Tool-blocks Used in Cutting Grooves in Conical Part

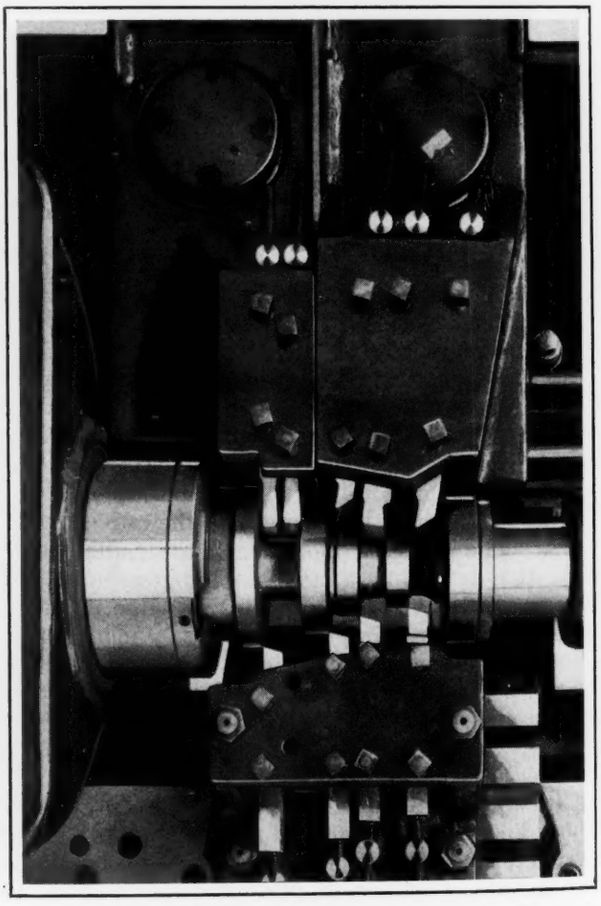


Fig. 2. Set-up Employed in Turning and Facing Cluster Gear Blanks

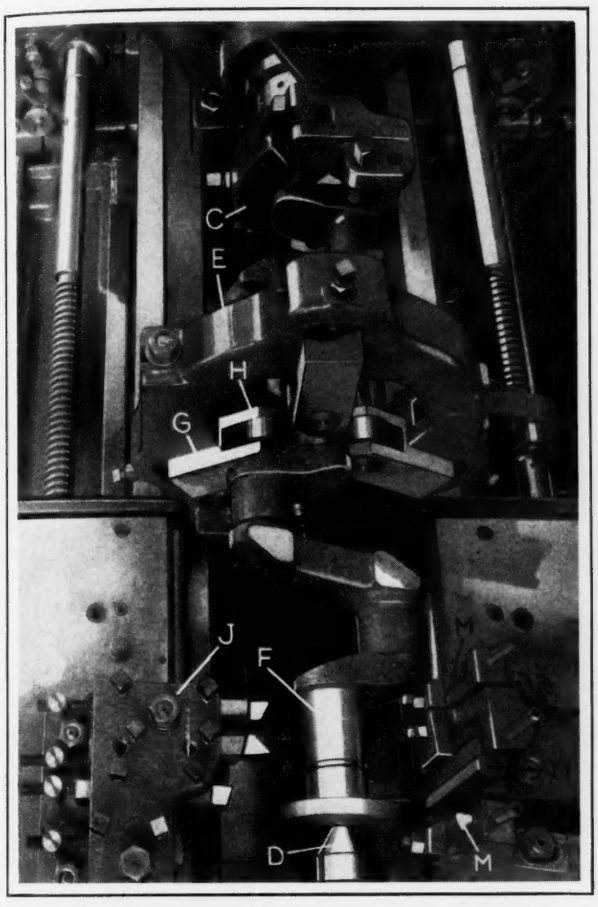


Fig. 3. Special Chuck Steadyrest, and Tools Used in Turning Crankshaft Flange and Bearing

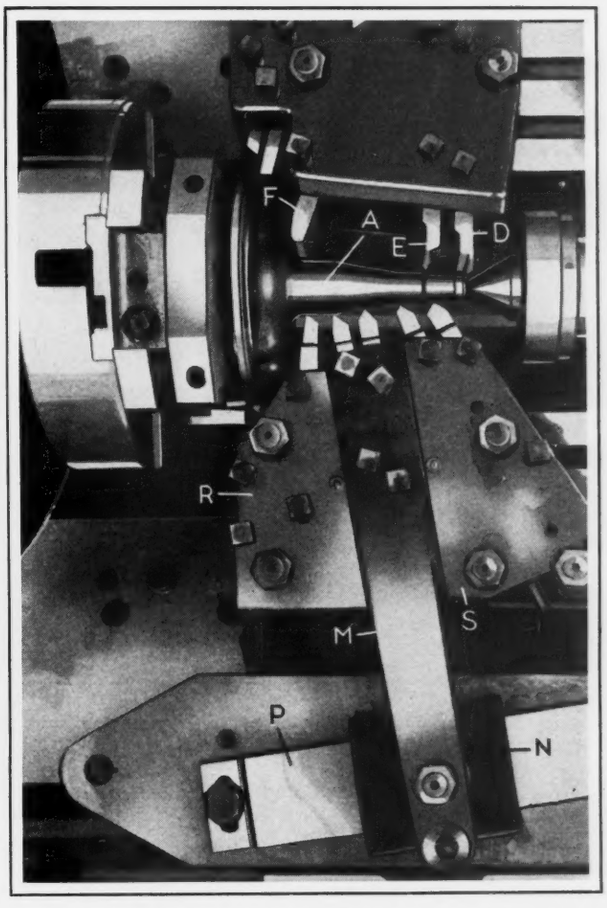


Fig. 4. Set-up for Performing Straight and Taper Turning Operations Simultaneously

Tool Equipment for Facing and Grooving a Balance Wheel

In Fig. 5 is shown a set-up for facing and grooving the balance wheel shown by heavy dot-and-dash lines. The three tools mounted in the front cross-slide perform the rough turning and facing operations, and those in the rear slide finish the work to the required dimensions. The work is held on an arbor mounted between the lathe centers, and is driven by the pins that project from the faceplate. The collar *A* is slotted at *B*, so that it can be removed by simply loosening nut *C*. This permits the work to be removed quickly from the arbor, as it can readily pass over the loosened nut *C*. Two arbors are used, so that one can be loaded while the other holds the work in the machine, thus speeding up the production.

In Fig. 6 is illustrated a centering and expanding arbor designed to hold the gear blank shown by heavy dot-and-dash lines while facing. The arbor *A* is attached to a sleeve *B*, which is screwed on the nose of the machine spindle. The arbor is held in place on the sleeve by a tapered pin *D*. The bearing portion *E* of the arbor centers the work while the expanding portion *F* is forced to grip the work by tightening the nut *G*. The shoulder at *J* serves to position the work longitudinally. Both the front and rear tool-slides are used, one tool-block holding the roughing cutters and the other the finishing cutters.

Special Driving Fixture and Tool Equipment for Turning Crankshaft Flange

The special driving fixture shown at *C*, Fig. 3, grips one end of the crankshaft, while the opposite end is supported by the tailstock center *D*. The steadyrest *E* supports the crankshaft bearing that is concentric with the flange end *F*. This steadyrest has adjustable jaws *G*, which are fitted with rolls *H* that revolve on hardened pins.

A group of cutters held in the tool-block *J*, which is mounted on the front slide, acting in combination with another group of cutters secured in holders on the rear slide, perform the turning and facing operations on the flange end of the crankshaft, including the bearing surface. The rear cutters *M* are of the broadnose shaving type and are held in a vertical position.

Tool-block Designed for Combination Straight and Taper Turning

The machining of the steering knuckle *A*, Fig. 4, involves straight and taper turning. To meet these requirements, a special tool-block consisting primarily of three members *R*, *M*, and *S* is employed. The members *R* and *S* hold tools that perform straight turning operations, while member *M* holds the two cutters that turn the tapered portion of the steering knuckle.

The cutter *D*, held in the tool-block on the rear cross-slide, turns the rounded end of the work, tool

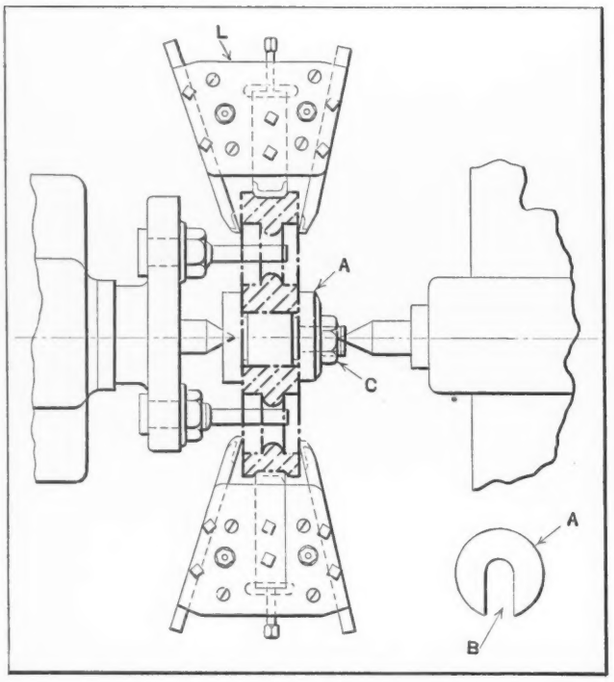


Fig. 5. Arbor and Driving Plate Employed with Dual Tooling for Machining Balance Wheel

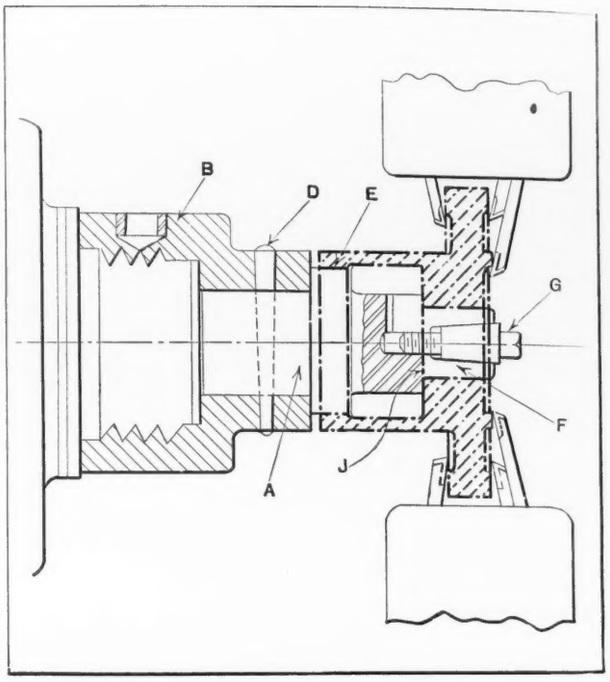


Fig. 6. Expanding Arbor with Centralizing Plug Designed for Facing a Special Gear Blank

E cuts the grinding recess, while tool *F* finishes the rounded corner next to the flange. These cutters are fed inward toward the center of the work.

The tool-blocks on the front cross-slide are fed to the left, the movement of the cutters in members *R* and *S* being parallel with the axis of the work. While these cutters are engaged in turning the straight portions of the work, the cutters in member *M* turn the tapered portion. As the carriage of the machine is fed to the left, the member *M*, which is in the form of a slide, is moved outward by the plate *P*, which is set to the angle required to produce the correct taper. The sliding block *N* is pivoted to the outer end of member *M*.

Dual Tool Equipment for Radius Turning

Rough and finish radius turning cuts are taken simultaneously on the part shown in heavy dot-and-dash lines, Fig. 7, by employing dual tooling. The familiar slotted cam-slide arrangement actuates the roughing tool *M* and the finishing tool *L*. As the tool-blocks *A* and *C* travel to the left, the heads of the screws *B*, coming in contact with the slides *G* and *H*, cause the slides to recede within the retaining members *D*.

This action, in turn, causes slides *E* and *F* to move in and out in accordance with the curvature of the cam slots *J*. Springs *S* keep the slides *G* and *H* in contact with the screws *B*. The tool *L*, which takes the finishing cut, is, of course, set slightly to the rear of the roughing tool *M*.

* * *

At the end of November there were over 9300 airplanes registered with the Department of Commerce, and over 8900 licensed pilots. The department has issued certificates for 262 approved types of airplanes and 32 aircraft engines.

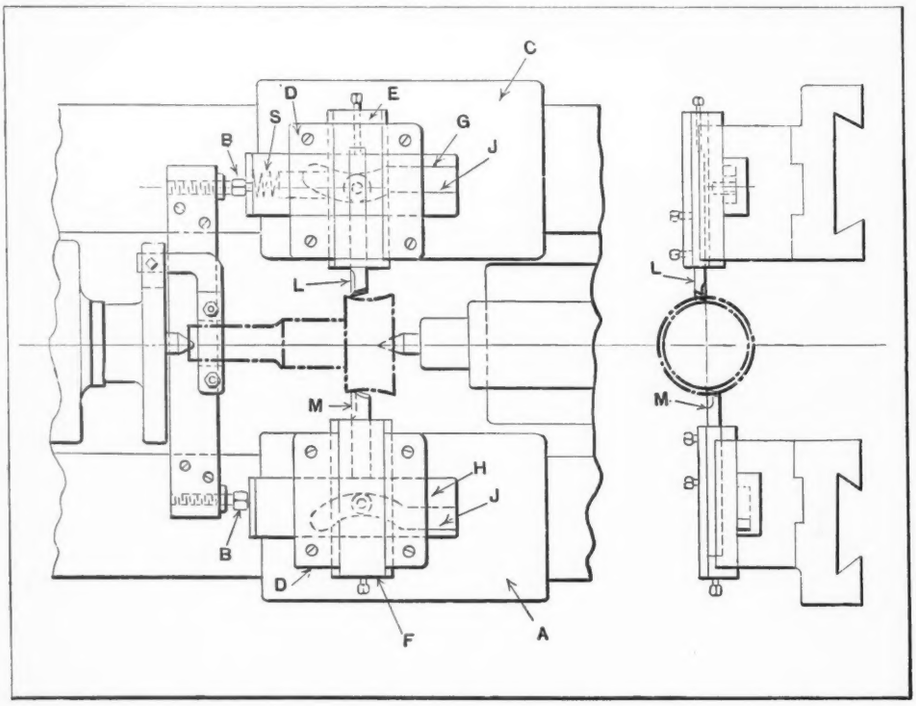
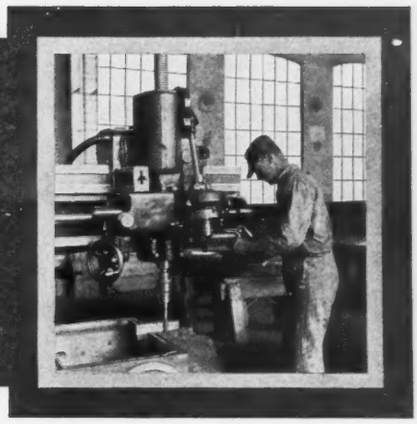


Fig. 7. Dual Tooling for Rough and Finish Radius Turning

Letters on Practical Subjects

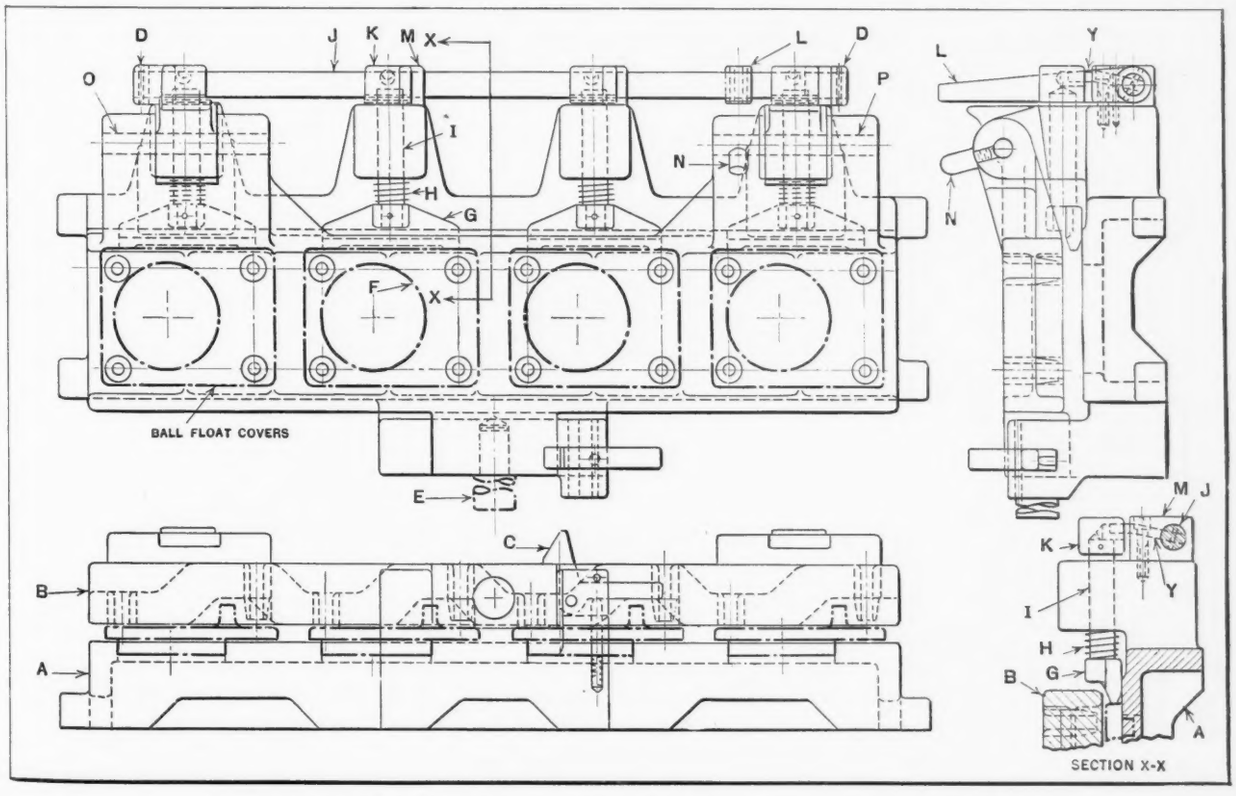


MULTIPLE JIG WITH AUTOMATIC LOCATORS

At times it is possible, with slight changes, to increase production by facilitating the handling of work in jigs or fixtures. The multiple jig shown in the illustration is an example of this kind. By adding a few simple parts, the locators, previously operated by hand, now function automatically as the jig leaf is opened or closed, thus increasing production considerably on the ball float covers shown in heavy dot-and-dash lines.

Four of these covers are drilled at one time in a multiple drilling machine, their rabbets being centered in the bores *F* of the jig. Previously the individual squaring blades *G*, fastened to plungers *I*, were held back, one at a time, by the fingers until the covers were seated on the base *A;* on being released, the blades were forced against the side of the cover by the action of coil spring *H*. The plungers are a slip fit in projecting bosses on base *A*. The jig leaf *B*, hinged at *O* and *P*, is shaped to clear the top lugs on the covers and is locked in the drilling position by the spring-actuated finger-latch *C*. Hand-knob *E* is used for opening and closing the leaf.

To permit automatic functioning of the locators, a shaft *J*, which is a running fit in the four blocks *M* mounted on the rear of the jig, is equipped with fingers *Y*, which engage holes in the collars *K*, the latter replacing the plain collars previously used. The lever *L* is also fastened to the shaft. Collars *D* retain the latter in its proper position. Screwed into the hinge on the jig leaf is the pin *N* which, when the leaf is opened, forces lever *L* back and revolves the shaft through a partial revolution. This action also causes the fingers *Y* to carry the plungers *I* back and the blades *G* away to clear the covers while they are being loaded into the jig.



Jig for Drilling Ball Float Covers, Equipped with an Automatic Locating Device

When the loading is completed, the leaf is closed, releasing lever *L* and permitting the coil springs *H* to force the blades *G* against the covers and square them up.

Glen Ridge, N. J. J. E. FENNO

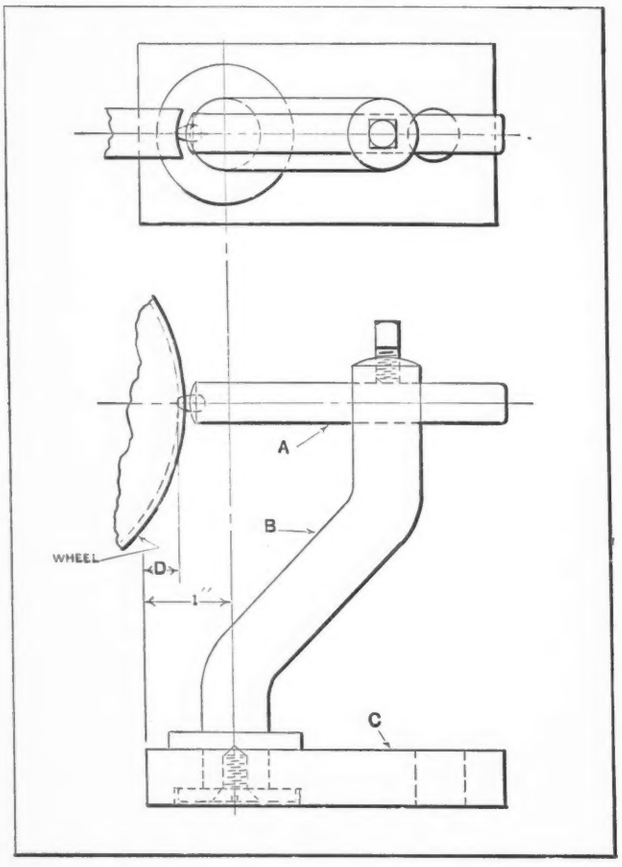
DRESSING TOOL FOR CONCAVE OR CONVEX WHEELS

The tool illustrated is used for dressing grinding wheels to the concave or convex shapes necessary for grinding forming tools; in the illustration, it is shown set for a concave wheel. The diamond-holder *A* is fastened securely by the set-screw in the offset arm *B*, the latter revolving in the base *C*, which, in turn, is fastened to the grinding machine table.

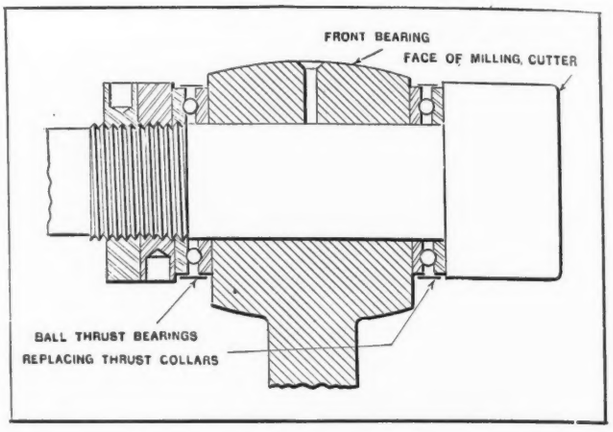
To set the diamond point correctly for truing the wheel, a square or straightedge is placed against the front end of the base. As the 1-inch dimension remains constant, the measurement *D* to the diamond point will be equal to 1 inch less the concave radius. For a convex wheel, the diamond point will be drawn back on the other side of the center line a distance equivalent to the convex radius.

To operate the tool, the diamond point is fed against the wheel and given the required circular motion by revolving the arm *B* in the base. This tool is also used to dress the wheels when grinding the chamfers on chasers.

Minneapolis, Minn. WILLIAM MANDER



Diamond Dressing Tool for Convex or Concave Grinding Wheels



Ball Thrust Bearings Applied to Milling Machine Spindle

EQUIPPING MILLING MACHINE SPINDLE WITH BALL BEARINGS

Recently the writer was confronted with the problem of eliminating the heating of thrust collars on the spindle of a special milling machine on which two face milling cutters were mounted, opposite each other. The work, which is faced on opposite sides simultaneously, must be parallel, and as any play in the spindle would permit the latter to move in or out at the beginning and end of the cut, it was decided to substitute ball thrust bearings as shown in the illustration. To test the value of this change, ball thrust bearings were mounted on one spindle only, a dirt guard (not shown) being provided for the outside bearing. Very little machine work was required for the installation.

The machine, thus equipped, has been in operation for approximately five years, and the ball-bearing-mounted spindle has shown practically no sign of wear, while the plain thrust collars have worn nearly 0.050 inch. In view of the results of this test, it would seem that the application of ball bearings should be highly profitable to machines of the type described. D. A. H.

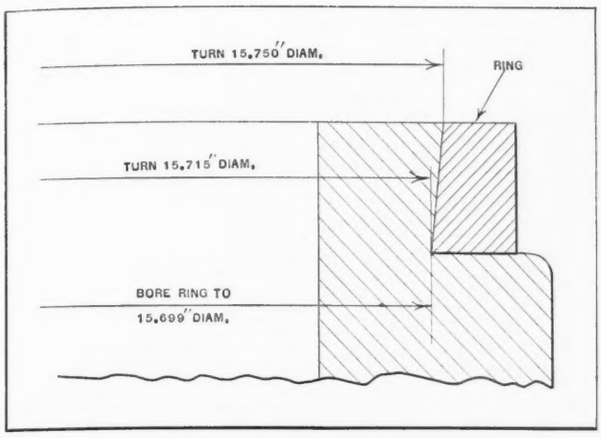
ASSEMBLING RINGS WITH TAPERED SHRINK FITS

The shrink-fitting of a ring on a slightly tapered seat or shoulder, as indicated in the illustration, is a method of assembling which has various applications. It offers the solution to many assembling problems and should be kept in mind by designers generally.

In order to shrink the ring on the shoulder, it is obvious that it must be expanded sufficiently by heating to permit the small end to pass over the large end of the seat. Assuming an allowance for the shrinkage fit of 0.001 inch per inch in diameter, the bore at the small end of the ring will be 15.699 inches. When the ring is heated to, say, 800 degrees F., the amount of expansion will be

$$15.699 \times 800 \times 0.0000065 = 0.0816 \text{ inch}$$

Thus, when hot, the small end of the ring has a diameter of $15.699 + 0.0816 = 15.781$ inches.



Cross-section of Ring, Showing Tapered Shrink Fit Joint

Therefore, the small end of the expanded ring has a clearance over the large end of the seat of 15.781 — 15.750 = 0.031, or 1/32 inch, which is sufficient.

By heating the ring to a higher temperature, the seat can, of course, be given a considerable taper. However, there is a limit to the amount the ring should be expanded, since there is danger of setting up stresses on cooling which may exceed the elastic limit of the material, in which case the ring would fail to grip the seat or, in extreme cases, the ultimate strength of the material might be exceeded, causing the ring to burst.

Philadelphia, Pa. B. W. BARISH

HOW ONE PLANT DEVELOPS NEW DESIGNS

An unusual method of developing special machinery is used in a plant manufacturing small electrical equipment. This plant maintains two experimental departments, entirely separate from each other. The ideas worked out in these departments either originate there or are furnished through the employes' suggestion box, duplicate copies of the suggestions being made, one for each experimental department.

With this material, each department head makes preliminary lay-outs, or, if possible, an inexpensive model to demonstrate the advisability of proceeding further with the idea. When both departments have carried their work up to a point where a good demonstration is possible, a conference of the superintendent, master mechanic, and production foreman is arranged to take place in each of the experimental departments. After discussing the various merits of each design, a decision is made as to which of the two designs is more suitable. The chosen model is then developed fully on paper, blueprints are issued to the machine shop, and the machine is built.

While this procedure might be expected to cause a great deal of tension between the departments, the opposite is true. Interest is also maintained by offering a prize, which gives the department that has developed a successful machine, a substantial money reward, in proportion to the gain in production made possible by the new machine.

The experimental work is not very expensive, as the greatest part of the work can be carried out roughly by the use of inexpensive models, built at the bench, for demonstrating the doubtful parts of a design. The company, in commenting on the increased cost of maintaining two departments identical with each other, calls attention to the fact that the machine equipment resulting from this system has been of the highest order, and that the results warrant the added expense.

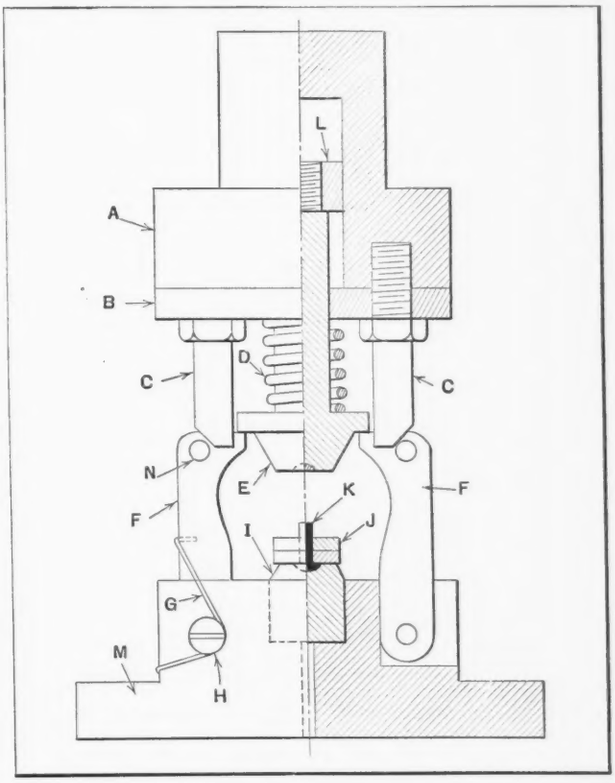
The incentive due to the prize involved, coupled with the departmental competition, promotes an "on your toes" spirit which would be lacking in some degree if the work were carried out in one department under one head.

Glen Ridge, N. J. F. E. JUDSON

DOUBLE-BLOW RIVETING DIE

The die shown in the accompanying illustration was designed for use in riveting together two small plates. The interesting feature of this tool is that the heading die strikes the rivet a blow before the final setting blow is delivered, the object being to avoid upsetting the body of the rivet before the head has been at least partly formed. This operation is based on the theory that light, quick blows are better for forming the rivet head than a heavy single blow which tends to expand the body of the rivet.

The upper and lower dies *E* and *I* are carried in the holders *A* and *M*, respectively. The upper die *E* is free to slide in the holder *A*, and is backed up



Riveting Die which Delivers Two Blows at a Single Stroke of the Press Ram

by a heavy spring *D* which delivers the initial blow. A collar *L* is screwed on the shank end of die *E*. This collar serves as a retainer and guide, and by bottoming in the blind hole in holder *A*, takes the force of the blow which sets the rivet as the ram of the press reaches the end of the downward stroke.

The lower die-holder is provided with two pivoting arms *F*, which engage the shoulder on the heading die *E*, causing the spring *D* to be compressed as the ram descends. The continued downward movement of the press ram brings the angular surfaces of the studs *C* in contact with pins *N*, causing the arms *F* to spread apart and thus disengaging the heading die *E*. Studs *C* are furnished with nuts which act as retainers for the plate *B*. The arms *F* are provided with springs *G* held under the heads of screws *H*, which return the arms to the die-engaging position on the up stroke of the ram.

As the arms *F* are disengaged from die *E*, the pressure on spring *D* is released and a quick blow is delivered to the rivet *K*. This has the effect of upsetting the protruding end of the rivet. The pressure of spring *D* must be determined by experiment, the force of the blow being such that the head is partly formed without upsetting the portion of the rivet that passes through the work *J*. As the press ram continues downward, the collar *L* bottoms in the hole in holder *A*, so that the final setting of the rivet takes place at the extreme end of the downward stroke.

Philadelphia, Pa. R. H. KASPER

METHOD OF REMOVING TUMBLING BARREL COVERS QUICKLY

While visiting a shop some time ago, the writer was impressed by the ease and rapidity with which the covers of a battery of horizontal tumbling barrels were handled. The tumbling barrels were used for removing the scale from large quantities of carburized parts and were arranged in a row. The type of fastening that made possible the rapid handling of the covers with the aid of an electric hoist is shown in the accompanying illustration.

The electric hoist, which served the entire battery of tumbling barrels, was suspended from an overhead rail. In removing the cover from a barrel, the hook at the end of the hoisting chain was simply connected to the eye *A* of the shackle *B*, and the hoist started. As the hoist raised the shackle *B*, the rods *C* pulled back straps *D*, withdrawing the pins *E* against the pressure exerted by springs *F*. As soon as the pins *E* cleared the holes in the ends of the barrel, the cover *G* was released and lifted free of the barrel, by the upward movement of the hoist. The cover was made of boiler plate, amply reinforced by angle-iron.

New York City B. J. STERN

MULTIPLYING NUMBERS WITH TABLE OF SQUARES

Designers who must solve mathematical problems connected with their work, and checkers who have to check the answers, may be interested in the way the writer uses the table of squares in MACHINERY'S HANDBOOK. To multiply two factors of three and four digits, the sum of the two factors being less than 2000, the writer proceeds as follows: The two factors are added and the square of the sum thus obtained is taken from the HANDBOOK. From this is subtracted the square of the difference between the two factors, after which the remainder is divided by four to obtain the desired product. For example, what is the product of 1089 times 896?

Adding,

$$1089 + 896 = 1985$$
$$1985^2 = 3940225$$

Subtracting,

$$1089 - 896 = 193$$
$$193^2 = 37249$$

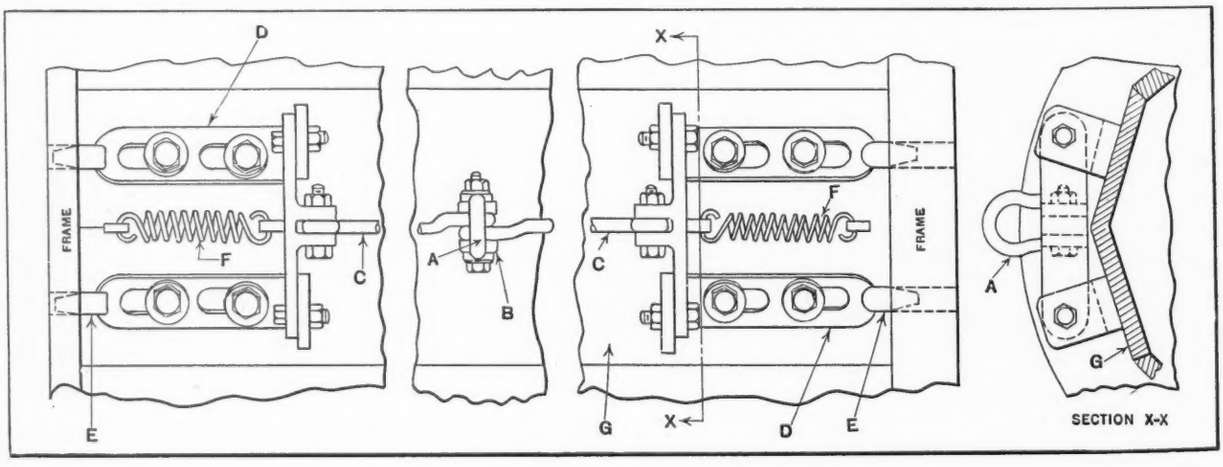
Now, subtracting the square of the difference from the square of the sum we have,

$$3940225 - 37249 = 3902976$$

Now,

$$3902976 \div 4 = 975744$$

which is the product of 1089 times 896.



Fastening Arrangement for Tumbling Barrel Cover

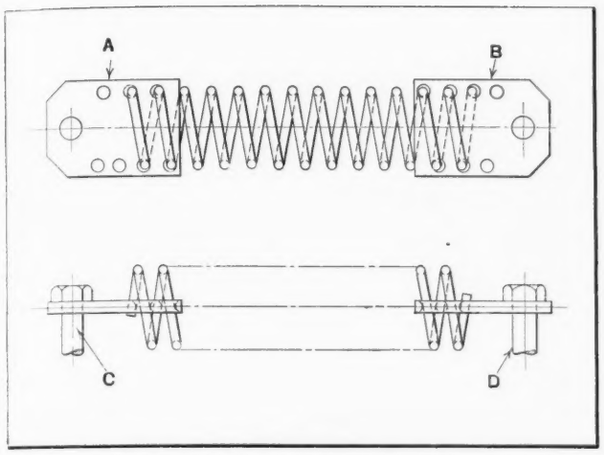


Fig. 1. Spring Held by Drilled Plates

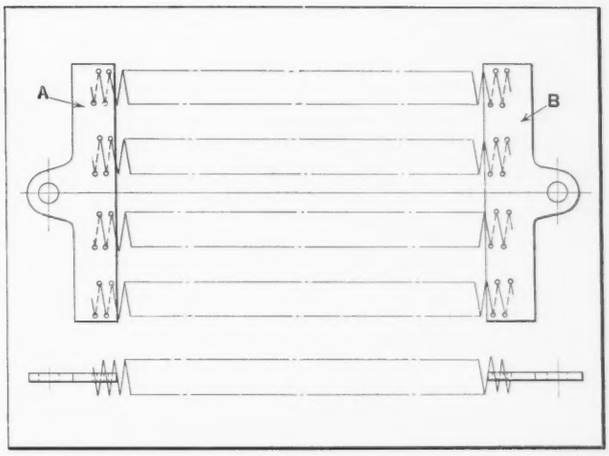


Fig. 2. Equalizing Suspension Plate for Group of Springs

Let the product of 997 multiplied by 996 now be obtained. We have,

$$997 + 996 = 1993$$

and

$$997 - 996 = 1$$
$$1993^2 = 3972049$$

Subtracting the square of the difference, which equals 1, from 3972049 we have 3972048.

Dividing 3972048 by 4 we obtain 993012, which is the result obtained by multiplying 997 by 996.

In the case of numbers in which 5 is the final digit of each factor, the product of two factors of four and five digits can be obtained, provided the sum of the two factors is less than 20,000. All factors are to be treated as whole numbers in obtaining the value of squares; the placing of decimals, whenever necessary, is left until the final result is obtained. The usual rule for placing the decimal point is then applied. To multiply 16.875 by 3.095, we proceed as before.

Adding,

$$16875 + 3095 = 19970$$
$$1997^2 = 3988009$$
$$19970^2 = 398800900$$

The square of the difference between 16875 and 3095 equals 189888400. Subtracting 189888400 from 398800900, we have 208912500. Dividing this number by 4, gives up 52228125. Placing the decimal point in the proper place, we have 52.228125 as the correct answer.

The foregoing method of multiplication also holds good where the difference between two factors of four figures each is less than 2000 and the last figures of the two factors totals 10, as for example, when multiplying 4897 by 3673.

Philadelphia, Pa. SAMUEL KAUFFMAN

END FASTENINGS FOR HELICAL SPRINGS

The methods of mounting helical springs shown in Figs. 1 and 2 have several commendable features. They are intended for use where the springs are subjected to tension. The fastenings are of simple construction and do not require loops to be made at the ends of the spring. They also permit the strain at the end to be divided between two or more coils, so that the full strength of the spring is retained at each end.

Referring to Fig. 1, the two plates *A* and *B* are attached by means of screws *C* and *D*, one end being secured to the fixed surface, and the other end to the movable part. The holes in the plates are spaced to correspond with the pitch of the spring. The extra holes permit the tension to be adjusted as desired.

The plates shown at *A* and *B*, Fig. 2, are drilled to receive four springs, which are held under tension the same as the one shown in Fig. 1. In assembling the springs and holders shown in Fig. 2, all four springs are first attached to one plate, following which they are coiled two or three revolutions by hand before being connected with the plate at the opposite end. The uncoiling action of the springs causes them to thread or attach themselves to the plates. By having one hole in each plate for connecting the assembly to the machine parts, the tension of all four springs is equalized, so that the action is the same as that of a single spring. H. M.

MARKING THE MACHINE WEIGHT ON NAMEPLATE

The article "Information for Installing Machinery" on page 12 of September MACHINERY, prompts the writer to suggest that the weight of every machine should be stamped on the nameplate or cast into the body of the machine. This information would be of value in making the original installation and also in moving the machine when necessary.

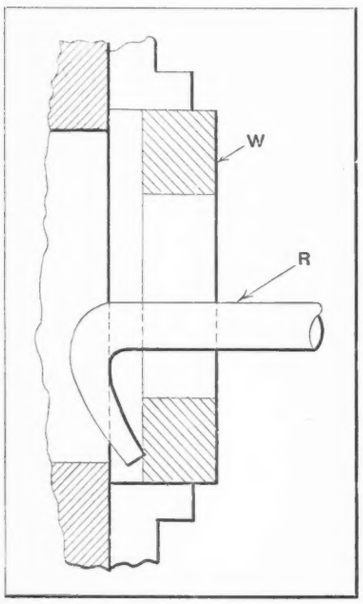
Too often the weight of a machine is incorrectly estimated, with the result that it is damaged through the use of handling equipment of insufficient capacity. Also, there is the danger that some of the workmen may be injured through accidents to the handling equipment. With the weight clearly marked on the machine, there is little excuse for such happenings.

Collingswood, N. J. LEWIS J. YAPP

FACING PARALLEL SURFACES

A number of methods have been described in MACHINERY for lining up work in a lathe chuck so that the front face can be machined parallel with the previously finished rear face. A method that has been used successfully by the writer for many years is to place four bolts in the slots of the chuck, fasten them in place with nuts, and take a light facing cut over their ends. The machined ends of the bolts then form locating points which lie in a plane parallel with the line of motion of the cross-slide. Any part having a finished surface placed in contact with the ends of the bolts will be properly trued up for facing the opposite side parallel with the finished side.

When opposite sides of a ring are required to be faced parallel, the method of locating work shown in the accompanying illustration may be used. In this case, the work *W* is gripped lightly in the jaws of the chuck, and a piece of brass or copper rod *R* formed as shown is used to true up the work. The brass rod is gripped in the toolpost of the lathe and passed through the hole in the work, being so adjusted that it comes in contact with the finished side of the work near the outer edge. By running the lathe spindle at high speed and moving the carriage toward the tailstock, the work will be automatically trued up by contact with the end of rod *R*. The chuck jaws can then be carefully tightened on the work. This method is often used in truing up work on a vertical boring mill.



Method of Truing up Rear Face of Ring

Philadelphia, Pa. CHARLES KUGLER

HOW SHOULD WORKING TOLERANCES BE EXPRESSED?

Judging from the various articles on the methods of expressing limits on drawing dimensions, which have appeared in MACHINERY from time to time, there is a considerable difference of opinion as to what constitutes the best method of showing tolerances. The three most common methods are as follows:

(1) 1.251 ± 0.001

In this case the mean dimension is given with the tolerance split both ways, that is, plus and minus.

(2) $1.250 \begin{matrix} +0.002 \\ -0.000 \end{matrix}$

Here the preferred dimension is given with an allowance one way only.

(3) 1.252 Max.
1.250 Min.

The maximum and minimum dimensions are given in decimals in this case, no plus or minus tolerance being indicated.

The first two methods are without doubt the most convenient for the designer and draftsman, because only one dimension is given, and in adding up figures and making other calculations, this dimension will be used and the tolerance will be disregarded altogether.

Drawings are made by the draftsman for the use of the men in the shop, and the less calculations the workmen are required to make, the better. For this reason, the writer considers the third method the best one for general shop use. Here we have a maximum dimension and a minimum dimension. Any measurement between these two will be accepted. All gages can be made to the drawing dimensions, and micrometer readings can be taken directly from the dimensions without first adding and subtracting tolerances, as would be the case with the first two methods.

We must bear in mind that all tools cannot be made directly to drawing dimensions, if they are to give the maximum service. Some must be made to the maximum size, and others to the minimum size, depending upon the nature of the operation and the type of the tool. A hollow mill, for instance, used for finishing the outside diameter of a part, will produce work which gradually increases in diameter as the tool wears. This type of tool should, therefore, be machined to the minimum dimension. On the other hand, a reamer, which produces holes that constantly diminish in size as the result of wear, should be machined to the maximum dimension.

Now, let us consider what effect the method of expressing tolerances has in the manufacturing department. In setting up for a certain operation, the operator is likely to adjust his machine to the basic dimension shown on the drawing if the first two methods of expressing tolerances are employed. In the first case, the working allowance will actually be cut in half. In the second case, the machine will either be set to allow the full limit or it may be set at the extreme end of the limit, in which case the operator will soon find that the finished parts are either too large or too small and he will be obliged to reset his machine.

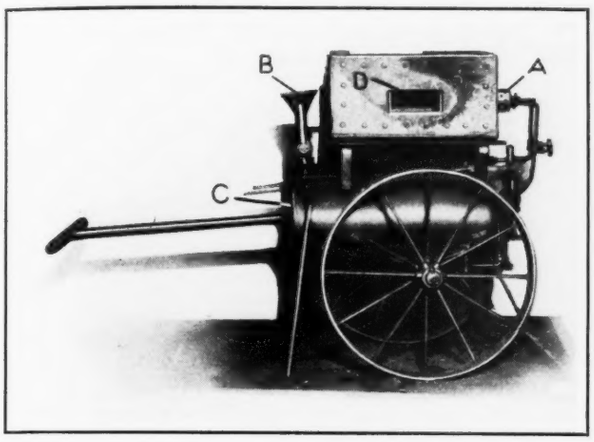
With the last method, the operator cannot fail to read the maximum and minimum dimensions on the drawing, and he knows that work outside these limits will be rejected. Under these conditions, he will naturally see the advantage of setting his machine to the dimension that will allow him the greatest working range with the type of tool being used.

New Britain, Conn. SVEND J. HELWEG

Shop and Drafting-room Kinks

PORTABLE RIVET HEATER

In doing hot riveting on work of large proportions, it is highly desirable to have the rivet heater located as near as possible to the work. This can be done by using the portable heating unit shown



Portable Rivet Heater Combining Fuel Reservoir and Furnace

in the illustration, which has replaced the previous type of coke heating furnace. Mounted on large wheels, this unit may be quickly and conveniently moved about by the operator.

The fuel, which is crude oil, is carried in the reservoir *C*, the latter being filled through the cone-shaped opening *B*. The oil is vaporized, through the use of compressed air, by being passed through an ordinary blow-torch nozzle and into the furnace at *A*. A rectangular opening at *D* is cut in one side to permit the insertion of the rivets to be heated.

Chattanooga, Tenn. H. H. HENSON

SALVAGING CARBURIZING COMPOUND

The following method is used by the writer in salvaging used carburizing compound. The carburizing compound is placed in a tank of water. As the burned compound is heavier than the water, it will sink to the bottom, while the unburned portion, which can be used over again, will float a sufficient length of time to allow its removal. If allowed to remain in the water too long, the unburned compound will become water-soaked and sink also.

St. Louis, Mo. HARRY E. NIEDERBREMER

MAKING DRAWINGS ON TRACING CLOTH

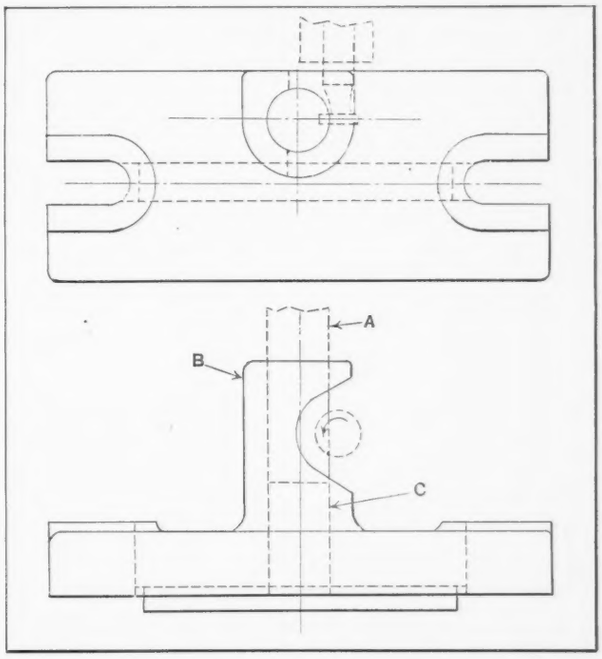
The old practice of making pencil drawings on detail paper and tracing them afterward is still adhered to in many drafting-rooms. The more advanced practice, however, is to make the pencil drawings directly on the tracing cloth and then ink them in, omitting only the lettering, dimensions, arrow-heads, etc. The tacks are then removed to allow the drawing to be placed in the most convenient position for filling in the details free-hand.

It has been found that the work can be done quickly and neatly by this method and with less fatigue to the draftsman. One of the advantages of inking in the lines directly on the pencil tracing is that there is no necessity for shifting the tracing cloth on the pencil drawing to compensate for changes in position resulting from variations in atmospheric conditions, as is the case when the older method is employed.

Philadelphia, Pa. HARRY KUPPER

MILLING KEYWAYS NEAR ENDS OF SHORT SHAFTS

The fixture shown in the accompanying illustration is used for milling Woodruff keyways in comparatively short shafts. The work *A*, which is held to a tolerance of plus or minus 0.001 inch on the diameter, is simply inserted in the fixture *B*, where it rests on the stop-pin *C*. The work is fed against the milling cutter until the proper depth is reached,



Fixture for Milling Woodruff Keyways in Short Shafts

and then withdrawn. It will be noted that the cutter rotates in a counterclockwise direction and tends to hold the work down against the stop-pin. This type of fixture is simple and inexpensive, and can be operated at a high production rate.

Rockford, Ill. W. E. GUNNERSON

Questions and Answers

ANNEALING MONEL METAL

L. M. S.—Will some reader of MACHINERY please explain the proper procedure in annealing monel metal to remove the stresses set up by cold-working?

Answered by W. E. Warner, Brentford, England

During the cold-working of monel metal, repeated annealing is necessary to remove the working stresses. The metal should be heated to a temperature slightly above 1650 degrees F., in a neutral atmosphere free from sulphur, and kept within the annealing temperature range of 1650 to 1750 degrees F. for five minutes, after which it is quenched in a cooling solution. It is necessary to transfer the article from the furnace to the quenching solution as quickly as possible in order to avoid an appreciable drop in temperature.

When cooled, the article will be properly annealed. A copper colored film will be formed on the monel metal, and it may be necessary to resort to pickling or buffing to remove this discoloration. The best quenching solution is a mixture of one part wood alcohol to eighty parts water.

FINDING RADIUS OF SEGMENT OF CIRCLE

A. L. M.—In the accompanying illustration, the segment S represents a portion of a cylinder, of which the radius CH is desired. Assuming that the segment S and square blocks T rest on an accurate surface plate, and that the measurement over the outer surfaces of the blocks is 16 inches, what would be the radius of the cylinder? It is assumed that the blocks have sharp edges and make perfect contact with the surface of the cylinder.

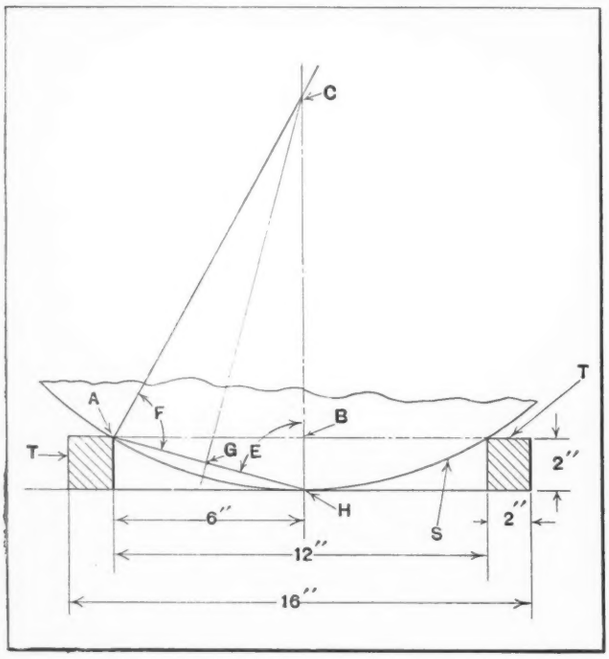


Diagram Used in Finding Radius of Segment

Answered by F. C. Mason, Chicago, Ill.

In this problem we have: $AB = 6$ inches; $BH = 2$ inches; $AH = \sqrt{6^2 + 2^2} = 6.32456$ inches; and

$$\text{Sin } E = \frac{6}{6.32456} = 0.94806$$

The angle corresponding to sin 0.94806 equals 71 degrees 27 minutes.

Now radius CH equals $\dfrac{GH}{\cos E}$

Substituting numerical values,

$$CH = \frac{3.16228}{0.31813} = 10 \text{ inches}$$

GUARANTEES MADE BY SALESMAN

Z.B.—A machine shop entered into a contract for the purchase of a second-hand welding machine through the medium of a traveling salesman in the employ of the seller. The salesman positively warranted this machine as being in perfect condition and as good as new. Acting on this warranty, and without inspection, as the machine was in another city several hundred miles away, the machine shop signed the contract of sale. The contract did not contain any warranty, but simply recited the sale of "One——welding machine, second-hand, f.o.b. Birmingham." Upon receipt, the machine was not as represented by the salesman; the machine shop demanded the return of the purchase price, but the seller declined to take the machine back on the ground that he made no warranty, and sold the machine as it was at his warehouse. Can the machine shop recover damages from the seller because of the false representations of the latter's salesman in respect to the condition of the machine?

Answered by Leslie Childs, Attorney at Law, Indianapolis, Ind.

As a general rule, there is no implied warranty in the sale of second-hand machinery, and if the buyer desires a warranty it must appear in the contract of sale. Further, it is usually held that oral representations made prior to or at the time a written contract is entered into are not a part of the contract as signed unless they are embodied in the contract. In the light of this, the machine shop will not be allowed to show the oral representations of the salesman, since they were not made a part of the written contract. And since the machine shop got the very machine covered by the written contract, it does not appear to be in any position to recover damages from the seller. (118 S.E. 512)

Filing Engineering Drawings and Records

A Simple System for Locating Quickly All Drawings and Records Required in Designing and Manufacturing Departments

By GEORGE O. SMILEY

IN many drafting-rooms the system of making and filing drawing records for reference is easily ten to fifteen years behind the rest of the plant. Because of this, the difficulty and the tremendous amount of time often consumed in making references is astounding. If information were as difficult to locate at the public library as it is in the average drafting-room file, many libraries would close for lack of patrons; yet the drafting-room files and the public library both exist for the same purpose—to collect and give out information.

Think of the vast quantity of knowledge hidden away in drafting-room files. For each individual industry these files constitute a highly specialized library. Quite apart from the monetary value of these files, another and less evident value obtains; they contain the whole history of the development of the company's product. In fact, there is today no mechanical nor electrical device and no engineering project whose whole history, from its inception in the mind of an individual to its final completion, may not be read from the files of some company's drafting-room. But the information too often is not accessible. The memories of various individuals frequently are relied upon to locate drawings.

The author of this article points out that the methods for indexing and filing drawings are far behind the up-to-date methods and processes used in other departments of industrial plants. Much time is wasted in trying to locate drawings and the information stored away in the filing cabinets of a drafting-room, because of inadequate and unsatisfactory indexing methods. It should be just as easy to locate drawings and the information given on them as it is to locate the books in a public library. The present article outlines a simple system of indexing and filing drawings that has been installed in a well-known manufacturing plant and has given highly satisfactory results.

In practically every drafting-room, of course, some attempt is made to file drawings and other records for future use. These attempts at classification and cataloguing differ more or less, and many of them are failures as a means of rapid, reliable reference. The lack of an adequate system for locating drawings and engineering data readily may be due to the fact that those in charge have been too busy drawing plans for new machinery to speed up production and reduce costs. On the other hand, speed troubled the libraries only because its patrons demanded the required information in less and less time; hence, a classification and catalogue index system was worked out to meet the demand for quicker references.

Such a system may, in principle, be applied to the drafting "library"—for in reality, the drafting-room files are an industrial library of a certain class of knowledge. Owing to the growth of these drafting libraries and, consequently, the increasing difficulty with which references are made, a modern filing system becomes proportionately more valuable. The vast difference between the time element involved in making references in the public libraries and in drafting-rooms is due to the lack of a proper classification and catalogue system in the drafting-room.

Installing a System for Filing and Recording Drawings

In the plant of the Hoover Steel Ball Co., Ann Arbor, Mich., the introduction of a system of classification and cataloguing of drawings somewhat closely approximating library practice met with instant success, and the cost of introducing the system was relatively low. The purpose of this article is to describe the important features of this system.

The necessary points to be observed in working out a satisfactory classification and catalogue index system are, first, it must not be clumsy, but must be easily workable; and second and all important, it must make possible quick and easy references. The essential points of the system may be stated in four sentences as follows:

1. It is a grouping together under common heads of things of a common nature.
2. It is a careful attempt at writing drawing titles that are clear, definite, and fully descriptive.
3. It is a method of accurately recording the important data concerning a drawing.
4. It is a system of filing the record cards that takes full advantage of their classification and the data recorded thereon.

Classification of Drawings

In short, the complete system is one designed to make possible ready references, such as are obtained at the public library, by borrowing the idea and adapting it to the needs of the drafting library. The first of the four points has to do with classification. Classification of the drawings is the foundation of the whole system, and alone makes it possible.

All library classifications divide knowledge into classes and subclasses. This system divides the knowledge contained in the drawings in the same manner, and as many subclasses are formed under each general head as are required to meet the individual need. The divisions and subdivisions are

natural in so far as possible. Arbitrary classes are formed only as a last resort in solving a particular problem.

The various titles and subtitles are arranged in alphabetical order in a record card-filing cabinet. By way of example, we might find under the general head of dies, the following cards: DIES—Assembling Dies; Blanking Dies; Forming Dies; Perforating Dies; Restriking Dies. The main head DIES is on one card, and each subhead is also on a separate card. The alphabetical filing order, referred to later, corresponds to general practice, serves to simplify locating a particular class. Anything that can make the system easy to use is to be desired.

Possibly the question has by this time arisen in the mind of the reader whether any special training is necessary to classify drawings. It must be admitted that such training is necessary. The ordinary engineer or draftsman may not be fitted either by training or experience to do this work. Although many classifications are evident at once, the determining of others may require much time.

In order to have the system function properly, every tool drawing must be correctly classified. If they are not, the same tool may be classified under two different heads. This will not happen if all classifications are correct. The writer asked a group of more than a dozen toolmakers and draftsmen to explain the difference, or relation, between an arbor and a mandrel. Not one was able to give him the correct answer. Several did not even recognize that a relation existed; and yet the proper use of such terms is essential. Many sources of information may have to be consulted in determining proper classifications of certain drawings. Eventually, it is hoped that an index will be available that will settle any doubtful classifications for the engineering librarian. The public library has such an index in "Index to the Dewey Decimal Classification."

Magnetic chuck for race grinding open type bearing inner ring on Van Norman grinder		0207-E PART NO. 2149 TOOL NO.	
PATTERNS		SHEETS	
LETTER	NAME	NO.	SIZE
A	Core	1	w
		2	x
		3(obs)	x
		4	w
		5	s

Fig. 1. Typical Drawing Record Card—Front View

The Importance of Definite Complete Titles

To make sure that the classification originally applied shall always be retained, the titles of drawings must be correct and complete, for it is the title placed on the record card that is the key to each individual drawing. References are made through the use of the index cards alone, and unless the title tells exactly what the tool is, for what and how it is to be used, the system is useless. The title must be carefully worded to tell everything essential about the drawing in a few words.

While installing the system for the organization mentioned, it was found necessary to change some 500 titles out of approximately 1200 considered. Most of these changes would be considered minor, but had, nevertheless, to be made to fit into the system. Because of this situation, a set of rules was written to serve as a guide in obtaining proper titles. These cannot always be followed to the letter, but they indicate the essential points to be covered. They follow in the order in which they are used:

1. State kind or type of thing drawn.
2. State name or general classification of thing drawn.
3. State purpose of thing drawn or operation for which it is used.
4. State name of part or mechanism on which thing drawn is to operate.
5. State machine, or machines, if any, in connection with which the thing drawn is designed to operate.

Note carefully how the following title satisfies all the conditions stated. "Ball chuck for use while bore-grinding Ford small cone on No. 3 Bryant grinder." "Ball" satisfies Rule 1; "chuck" satisfies Rule 2; "bore-grinding," Rule 3; "Ford small cone," Rule 4; and "No. 3 Bryant grinder," Rule 5. No one could doubt the nature of the drawing having such a title. And yet it could not be stated in fewer words if one bears in mind that the chuck, itself, does not do the bore-grinding. If the drawing were simply titled "Chuck for Ford Cone," it would be necessary to look at the drawing to find out for what it was intended, and even then one could not be sure. The necessity for titles that give all the essential facts is, therefore, evident.

The Record Cards for Drawings

The record cards form a very important part of the system. They are of two kinds. The first is a 3- by 5-inch card which carries the record of the drawing and is filed alphabetically in the catalogue index file. The second is a 5- by 8-inch card which is a "shop tooling" record. This is filed numerically by production part numbers, and forms a valuable auxiliary record when in doubt about a classification.

Figs. 1 and 2 show the front and back views of the small drawing record card. Note the information given. These cards are designed to be filled out with a small-type typewriter. By "Part No." is meant the produced part upon which the tool represented by the record operates. If the tool is used unchanged on two or three production parts,

a duplicate card is made out for each part number. For example, A-1202 and A-1204 are corresponding parts of the two front spindle bearings for the Ford Model A. Their chief difference is one of size. Because of their similarity, it is possible to use the same tool on certain operations on the two parts. Further, the corresponding parts for the T-model bearings is denoted T-295 and T-296. One or two tools can be used on all four parts.

A separate card similar in every respect except that each carried only one of the part numbers was made out for the tool drawing and filed in its proper place. Whereas A-1202 and A-1204 would necessarily be filed close to each other, T-295 and T-296 might be filed far from them; but the method of making a separate card for each of the respective part numbers makes it unnecessary to recall or even to have any idea that a particular tool is used on more than one part. Simply to look under the part number in question is to find the required tool.

If the tool is charted so that, with certain dimension changes, it can be used on a group of similar parts, the word "Charted" is substituted for the part number, and the charted part numbers are shown in the record on the back of the card. In case the tool cannot be identified with any particular production part, the space is left vacant. In the space for the "Tool No." is placed the drawing and tool identification number. Eventually, it is contemplated that each item of the classification will carry an identifying number. For the small shop, this is not an important matter, but it assumes more importance in the larger ones.

The drawing title occupies the top of the card in the space provided. Below, under "Pattern," are listed the letter and name of any patterns that may be part of a given drawing. Listing the patterns thus on the record card saves time later, for when a pattern is to be made, it is only necessary to get the pattern letter and tool number from the record and order it without referring to the drawing.

At the right, under "Sheets," are listed the individual sheet numbers and their sizes. Standard drawing sheet sizes were indicated by certain small letters and these letters used on the record. This information tells exactly in which file to look for any particular drawing. It also makes clear just how many sheets compose the drawing in question. If any one of the sheets of a drawing becomes obsolete, the abbreviation "(obs)" is inserted at the right of the sheet number. Thus all the information needed to take any drawing from the filing cabinet is on the front of the card.

On the back of the card (Fig. 2) is the complete record of the drawing. The name or initials of the draftsman, the date of the drawing, and the original number of sheets are recorded in the space provided. As already stated, the production part numbers of a charted drawing are recorded here also. Thereafter, any change that affects an entire sheet or the whole drawing is recorded in this space. For example, if a sheet is redrawn, another sheet added, or if one becomes obsolete, such information will be recorded here, together with the date and the draftsman's initials.

When a drawing becomes obsolete, it is so stamped in red on the front of the card in the title space. In the record on the back are recorded the date of obsolescence and the drawing number that supersedes it, if any. The card is retained in the catalogue index file, but the drawing is removed to a special file for obsolete drawings. Thus we have the complete history of any drawing in neat and compact form. It is filed for reference, and can be located at once if desired.

RECORD

Drawn by A. H. B. Date 5-5-29 No. of Sheets 3

Sheet 3 obsolete and superseded by sheet 4
6-10-29 A. H. B.

Sheet 5 added 8-2-29 E. A. B.

Fig. 2. Rear Side of Drawing Record Card

The Tooling Record Cards

The tooling record cards (see Fig. 3) are not a necessary part of the system, but form a valuable auxiliary. These cards are records of tools required to produce a given production part. Every shop has to make a similar tooling lay-out to find what tools are necessary to produce a new part. In this case, however, the record has been made doubly valuable by listing the tools in the order of the operations on the part. Thus, if the drafting library is asked for a drawing of the tool that performs a certain operation on a certain part, but the inquirer is not sure which tool is used, reference to this record will tell at once. This record must be compiled in some form in order to tool up. It is but a simple matter to make it a progressive operation tooling record, and is well worth while.

Filing the record cards so as to take advantage of all the information contained thereon is the final step in the system. The method of filing makes the information recorded on the cards accessible, and it is the index to the drawing files.

General System of Filing Cards

Any filing system should be of such a simple nature that the user can easily understand it. The system adopted satisfies this requirement; at the same time, it makes a card catalogue index of all the drawings in the files, and is very similar to the card catalogue in use in every library. But it should be understood that the system, as applied

in designing departments, must be based upon the three points already discussed, that is, classification, proper titling, and proper record forms.

Cards for the various classes and subclasses of equipment are placed in the file in alphabetical order, as previously mentioned, and in order to distinguish readily between main heads and subheads, index cards of two colors are used (another library practice). The index card tabs are one-third the length of the card; this makes a satisfactory width when the cards are filled out with a small-type typewriter.

For the classifications, a salmon colored card is used, and the title is typed in capitals. Typed in black, the contrast is good and the card is easily read. A buff card is used for the subclasses. These cards are typed in capitals and small letters, thus making two complete and readily observed distinctions between the heads and the subheads.

The importance of correct titles has already been stressed. It is in the filing of the record cards that these titles play their most important role. Recall the first and second rules for checking drawing titles. The second rule determines the classification of the drawing, while the first rule determines the subclass into which it falls; thus, the location of the record card in the index file can be accurately determined.

TOOLING RECORD

0207-E (PART NO.) — INNER RING, OPEN TYPE BALL BEARING (PART NAME)

TOOL NO.	NAME	OPERATION	USED ON
1358	Cir form tool	Rough turn	M. S. Gridley
2317	Ver form tool	Machine radius	" "
2318	" " "	Machine radii	" "
1359	Cir form tool	Finish form, OD	M. S. Gridley
2473	Arbor	Test eccentricity	
819	Plug gage	Gage	
1306	Ball race radius gage	"	
2412	Height gage	"	
2271	Bushings	Stamp	Auto press
2429	Stamp	"	" "
1293	Ball chuck	Bore grind	Bryant
2149	Magnetic chuck	Race grind	Van Norman
1656	Nose piece	" "	" "
819	Plug gage	Gage	
1659	Spinning fixture	Clean	
2519	Stub arbor	Sound test	
1306	Ball race radius gage	Gage	
2530	Height gage	"	
1411	Fixture	Grease load	

Fig. 3. Record of Tools Required to Produce a Given Part

A Specific Example of the Application of the System

Take the illustrative title previously used: "Ball chuck for use while bore-grinding small Ford cone on No. 3 Bryant grinder." The record card (Fig. 1) will be found under the general head CHUCKS, under the subhead "Ball Chucks." But in order to further simplify the location of the card, it is filed numerically by part number within the subhead. This method of filing is the reason for placing the part number in the upper right-hand corner and above "Part No." on the card, where it is seen most easily. If a group of cards is picked up together (removing them from the file is to be discouraged because of the possibility of misfiling), the average person will hold them in his left hand and thumb them with his right, so that the right-hand corner is preferable for numbering.

The Ford small cone in question is known as A-1219. The prefixed letter is only used for filing purposes in case of duplicate following numbers, when the A would come first, B next, and so on, and the card located after 1218. Examples of this condition will be shown later.

The part A-1219 is one of the members of the taper roller bearing assembly used in the Ford Model A front spindle. The complete assembly bears a different number, which is stamped on it in two places during manufacture. In this case, the consumer (Ford Motor Co.) designated the numbers for each of the component parts of the bearing. All numbers are prefixed by the letter "A," as are all parts used in the assembly of the Ford Model A passenger cars to distinguish them from the Model T predecessor, and the truck models, TT and AA. The consumer does not always designate a prefixed letter or name, but usually will not object to such use.

The Use of the Prefixed Letters

Now for some concrete examples which will illustrate the further use of these prefixed letters. Another part already mentioned for the Ford bearing assembly is denoted A-1202. While producing it, a bearing was being made for another firm whose

number for it is 1202. As Tyler is part of the firm name, they requested that the bearing be stamped, "Tyler-1202." The name and number is made use of in the records. Cards for drawings relating to these part numbers were filed A-1202 in front of Tyler-1202.

To cite another example, a replacement part for the old T-model Ford is designated T-205. This is also a taper roller bearing. The same bearing with slight alterations was furnished to the Simmons Co. and denoted Simmons-205. In the records, the abbreviation Sim-205 is used. One of the standard S. A. E. bearings is denoted 205, and, while not actually in production at that time, there were a number of tool drawings for its production. The record cards were filed in the order 205, Sim-205, T-205.

To still further illustrate the use of these prefixed numbers a filing order will be listed that might occur under any given subhead. The numbers cited are actual part numbers either in production, or for which there were drawings of tools for production. 205, Sim-205, T-205, 306, 308, A-1202, Tyler-1202, A-1204, A-1217, A-1219, Tyler-1502, 1625, 8305. Note the numerical order of filing. No attention whatever is paid to the prefixed letter or name except where duplication occurs in the number following, when the alphabetical order is used.

The letter that follows the part number in Fig. 1 is in accordance with the recommendations of the S. A. E. specifications for annular and thrust bearings, and this does not relate to the filing system here described. In this instance, the letter E indicates that the part is an inner ring.

Filing Drawings that Cannot be Identified by a Part Number

For convenience, drawings that cannot be identified by a part number are filed first after the index card and charted drawings next, both in alphabetical order by title. After these come the record cards with part numbers filed as described. Some of the classifications will be of such a nature that no drawing classified under them can possibly refer to any production part. Such record cards are filed alphabetically by titles under their respective subheads.

If a drawing comes under a general head which has no subhead covering it, the record card is filed after the general classification index card, but before its first subclass index card, in the order already mentioned. As soon as two or three drawings of the same nature have been added, a subclass is designated to cover them, an index card is made out and inserted in the file in proper alphabetical order, and the records refiled in the new location. One of the most important advantages of having an individual record card for each drawing is that each card can be filed and refiled to meet any requirement without disturbing any other card. As to the tooling record cards, it is only necessary to file them numerically by part number and index them properly.

Advantages of the Filing System

The filing system described is such that any draftsman or file clerk can learn to use the catalogue index effectively with a minimum amount of coaching. It is this fact that commends it most. If the details of the first three points of the system, together with the actual filing of the record cards, are taken care of by a qualified individual—an "engineering librarian"—then anyone can quickly make a required reference. The whole purpose of the system is to modernize and speed up the procedure of the drafting-room files. The various points involved in replacing an existing record system with the one described cannot be dealt with in this article, as it would be an individual problem for each drafting-room.

This system of records for the drafting department has been used by the Hoover Steel Ball Co. for several months. With the numerical record that has been kept for a number of years, there are now three possible sources of information that may be consulted to find the number of almost any drawing in the files. One of these three sources is certain to reveal the number sought quite readily, no matter how obscure the drawing may be.

The necessary coaching in writing proper titles seems to have invaded and more or less permeated the whole drafting procedure. Better and more carefully made drawings appear to have resulted. The speeding up of the process of making a reference has been far greater than the management previously believed possible. Many errors in the tool-room are averted by the records kept of the drawing, and the foreman of the drafting-room now knows whether the blueprint given the tool-room is correct.

The Engineering Librarian Needs Specialized Training

While the system is readily workable under any set of local conditions, to function properly it must be administered by an individual with specialized training. His education and experience should fit him for the specialized task of classifying and cataloguing drawings, and a highly analytical mind is essential. One properly equipped for this work might well be called an "engineering librarian." The engineering librarian should be an expert in the productive methods, machinery, and materials used in the industry with which he is connected. Whether industry will see his value at once is doubtful, but the competent engineering librarian will demonstrate his worth.

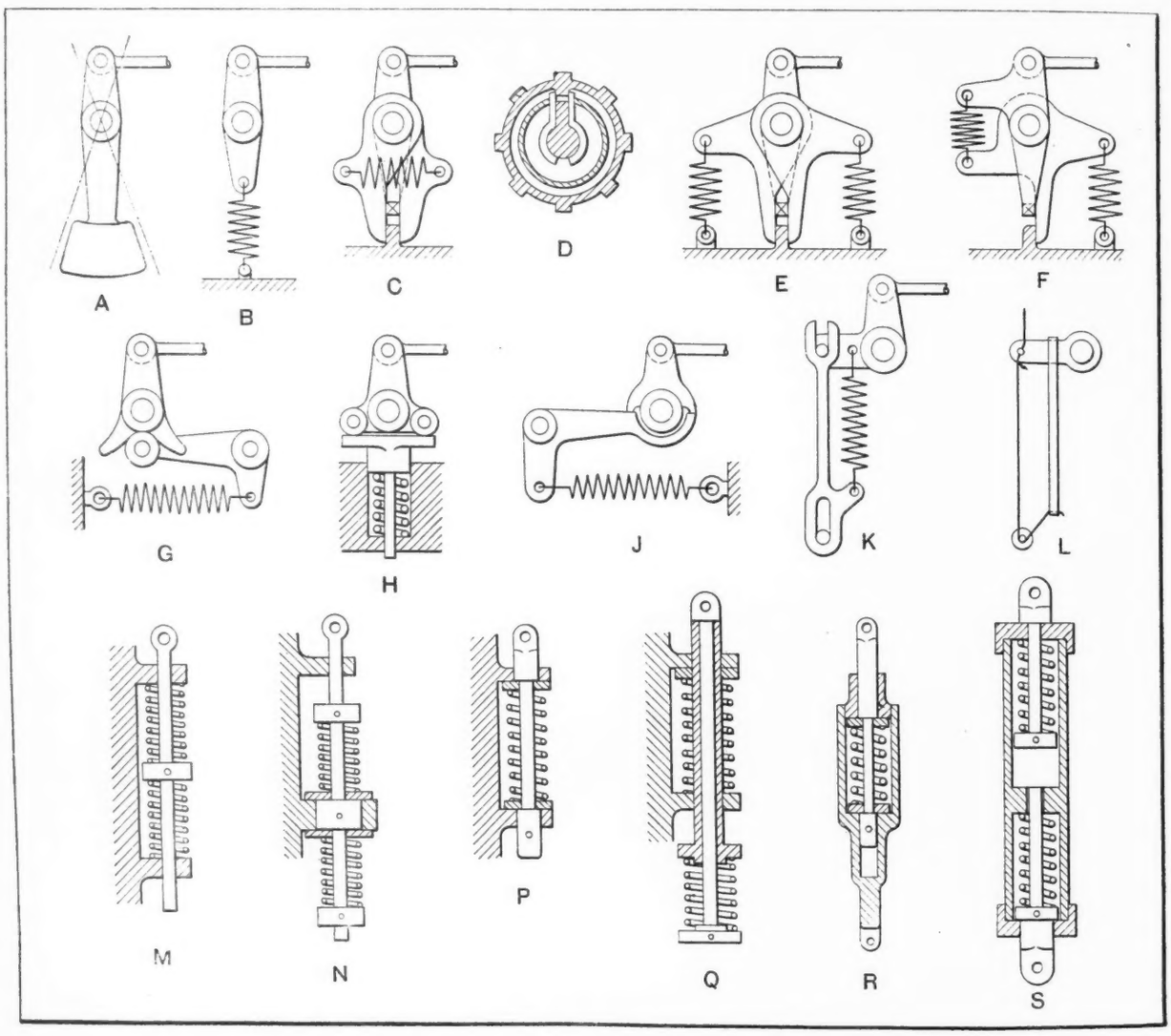
* * *

The proportion of tin in phosphor bronze has an important bearing upon the strength of the material. A 1/2-inch bar of phosphor bronze, for example, will have a strength of 32 tons per square inch with a tin content not exceeding 5 per cent. By merely increasing the tin content to 7 per cent, a tensile strength of 35 tons per square inch is obtained.

Design and Use of Self-Centering Devices

Pivoted Levers and Sliding Rods Provided with Self-centering Features Automatically Return Parts to Central Positions

IT is sometimes necessary or desirable to provide certain machine elements with mountings that will permit them to be deflected from or forced out of their normal positions by other parts of the machine. Usually such elements must be so designed or equipped that they will return automatically to their normal positions when the deflecting forces are removed. An ordinary spring buffer, for example, possesses this property, although it acts in only one direction.



Examples of Various Types of Mechanisms which Function as Self-centering Devices

The term "self-centering" is used in reference to the devices shown in the accompanying illustration, because they serve to return the elements to their central or normal positions when the deflecting force is removed. Probably the most familiar example of a self-centering device is the spring-actuated control rod employed to operate a dog-tooth clutch. With this type of clutch, the two members may not be in the correct angular relation to permit them to engage when the control lever is thrown over. Under these conditions, it is the function of the self-centering spring-actuated control rod to yield and permit the clutch lever to be thrown over without unduly straining the mechanism, causing the two parts of the clutch to engage as soon as they are in the proper positions.

Another application of self-centering devices is to the control levers of power-operated machines. For such applications, the lever is normally held in the neutral or central position by the self-centering device, and is returned to this position automatically as soon as it is released by the operator. Manual

operation of the lever in one direction or the other places the machine either in forward or reverse motion, and its release causes the machine to stop.

Self-centering Devices for Angular Movement

The attachment of a weight, pendulum fashion, as shown at *A* in the illustration, is one of the simplest examples of a self-centering device having an angular movement. A device of this kind may be used for a lever having a range of movement of 20 degrees each side of the vertical center line. This type of self-centering device, however, may be objectionable on account of the inertia introduced by the weight. Another objection is that the weight offers little resistance to angular movements of small amount, as the self-centering force is zero at the central position. Still another objection is the tendency of the weight to oscillate after displacement.

The device shown at *B* is similar to the one at *A* except that spring tension is substituted for the weight. This type of self-centering device is often used and is fairly effective for some purposes. The self-centering effect, however, is zero at the mid position of the lever, and effective centering forces are not developed until a considerable angular movement of the lever has taken place. The lever also has a tendency to vibrate after the decentralizing forces begin to act. In practice, short stiff springs are usually employed, which cause a heavy pressure to be exerted on the bearings or pivots of the lever.

The self-centering device shown at *C* typifies the traditional approved practice. Two clip levers pivoted about the boss of a lever are employed in this device. A pin carried by the lever is gripped between the two clip levers with a force depending upon the initial tension of the spring connecting the ends of the clip levers. Another pin of the same width as that on the lever is fixed to the stationary framework of the machine and interposed between the two clip levers. The result is that no movement of the lever in either direction can take place without forcing the clip levers apart against the resistance of the spring. The majority of self-centering problems involving angular movement can be solved by the application of the principles embodied in this device.

Self-centering Device Applied to Electric Switch

The self-centering device employed on a rotary snap-action electrical switch is shown at *D*. The principle on which this centering device operates is similar to that of the device shown at *C*. In this case, a C-shaped spring is used to force the clip levers together, as the angular movement is only a few degrees. The centering forces are equal in both directions of angular movement in the devices shown at *C* and *D*.

It is sometimes desirable, however, that the decentering forces be more strongly resisted in one direction than in the other. A modification of the design shown at *C* to meet this requirement is illustrated at *E*. The unequal tension is obtained by employing two separate springs of unequal strength for the two clips. As the springs are anchored to the machine framework, it is a simple matter to provide them with means for adjusting the tension.

The designs shown at *C* and *E* have proved highly satisfactory in general practice, but when absolute precision in the self-centering action is necessary, the type shown at *F* is preferable. With the designs shown at *C* and *E*, any difference in the size of the two pins located between the clip levers will result in lost motion, whereas the design shown at *F* is free from this possibility.

In this design, one of the clip levers is dispensed with, and a spring is used to pull the main lever and the clip lever together. This provides a definite self-centering action without the possibility of the slightest lost motion, and has been successfully employed in the design of a shock absorber in a train of gearing connecting a gun to its elevation indicator. Under the shock of the recoil of the gun, the device yields, but immediately regains its proper position with respect to the indicating pointer. In this application, any lost motion would destroy the accuracy of the elevation indicator.

Roller and Spiral Cam-operated Centering Device

In the case of the self-centering device shown at *G*, the actuating forces are applied to the lever by a roller which is pressed into engagement with a spirally shaped cam through the action of a coil spring. The arrangement is similar to that of the "zeroizing" cam lever used in stop watches. By shaping the cam curves properly, any desired variation in the centering force can be obtained from the spring that presses the roller radially inward. A heavy pressure on the roller and the lever bearings would result if the pitch of the spiral cam were made small in order to secure a wide range of angular movement, and in such a case, it would be advisable to use ball bearings for the roller and for the lever bearings.

Another design, consisting of two arms extending in opposite directions and carrying rollers that are subjected to spring pressure from a radially sliding T-shaped piece, is shown at *H*. When the main lever is in the central position, the T-shaped piece exerts an equal pressure on both rollers. Angular movement of the lever in either direction results in one or the other of the rollers depressing the T-shaped piece against the action of the spring.

At *J* is shown a design similar to that at *H*, except that the rollers are omitted and a pivoted lever is used in place of the T-shaped piece. When there is a limited amount of space directly below the lever, this design may be used to advantage. The devices shown at *G*, *H*, and *J* possess one feature that is often desirable, namely, they permit the self-centering action to be rendered inoperative when desired by forcing the centering T-shaped piece or lever out of contact with the main lever.

At *K* is shown an interesting, effective and extremely simple self-centering device. There is no lost motion in this type, and it can be arranged to

give equal or unequal resistance to movement in either direction. It requires but one actuating spring, which can be readily provided with a tension adjustment.

The device is simply a flat connecting-rod slotted at each end, one slot being engaged by a pin on the lever, and the other slot by a pin secured to the machine framework in a fixed position. The spring is fastened to the connecting-rod and to the lever. If the upper end of the spring is connected at a point midway between the fulcrum of the lever and the connecting-rod, the self-centering forces will be equal in both directions. If the upper end of the spring is moved nearer the lever fulcrum, the self-centering force opposing clockwise rotation of the lever will be reduced, while the force opposing anti-clockwise rotation becomes increased. The action of this design is illustrated by the model shown at *L*. Three pins, a cardboard lever, a piece of wire, and an elastic band suffice to provide this working model of the device.

Self-centering Devices of the Sliding Type

One of the earliest types of sliding self-centering devices is shown at *M*. The centering forces are supplied by two springs acting in opposite directions on the sliding member. When flexible springs are used, the centering or positioning action is rather indefinite with this type of device, especially if the springs are flexible. The position of the sliding member depends upon the value of the force opposing the self-centering springs.

At *N* is shown what may be considered the usual or standard practice in the design of self-centering sliding members. In this case, the springs apply the centering pressure to washers placed on each side of a collar located on the sliding spindle. The inner sides of the washers engage the sides of a member that projects from the machine frame. Any vertical movement of the sliding member is resisted by the projecting member on which one of the two springs acts.

The springs may exert equal or unequal pressure on the collars, as desired. When an equal resistance in either direction is desired, the design is frequently modified, as shown at *P*, so that only one spring is required.

Methods of Eliminating Lost Motion

Unless the distance between the faces of the washers employed in the sliding self-centering device is equal to the corresponding distance between the faces of the projecting members, lost motion will occur. Where the posssibility of the slightest lost motion must be eliminated, it is better to use a device of the type shown at *Q*, in which the upper collar is pinned to the sliding member. In this design, the sliding member is mounted within a sleeve which is pressed upward against a projecting member on the machine frame by a spring. A depressing movement of the sliding member carries the sleeve with it. On the upward movement of this member, the sleeve cannot follow, and the sliding member rises out of the sleeve against the pressure of a second spring that acts between the two parts. With this arrangement, no lost motion is possible and the centering action is precise.

The device shown at *P* is commonly employed in the design of spring-actuated connecting-rods used in dog-clutch control link work and for similar purposes. At *R* is shown a typical connecting-rod of this class.

At *S* is shown a design, similar to that illustrated at *Q*, which is intended for use where the possibility of the slightest lost motion must be eliminated. In this design, both springs are of the same size and provide equal resistance to either compression or extension of the connecting-rod.

* * *

It will be possible for the United States to enjoy a continually increasing foreign trade as long as American manufacturers give the foreign buyer the best value for his money. There is no secret formula governing success in foreign trade. It is simply a matter of commercial merit.

Ingenious Mechanism Contest Prize Winners

The seventeen prizes offered by MACHINERY for the best articles on ingenious mechanical movements have been awarded as follows:

One Hundred Dollar Prize
- Alfred C. Anderson, Holbrook, Mass.

Fifty Dollar Prizes
- George H. Pickhard, Detroit, Mich.
- Fred L. Newdick, Columbus, Ohio.

Twenty-five Dollar Prizes
- A. W. Jansson, Kent, Ohio.
- L. L. Roberts, Detroit, Mich.
- B. F. Clark, New Brunswick, N. J.
- Frank E. Shailor, Detroit, Mich.

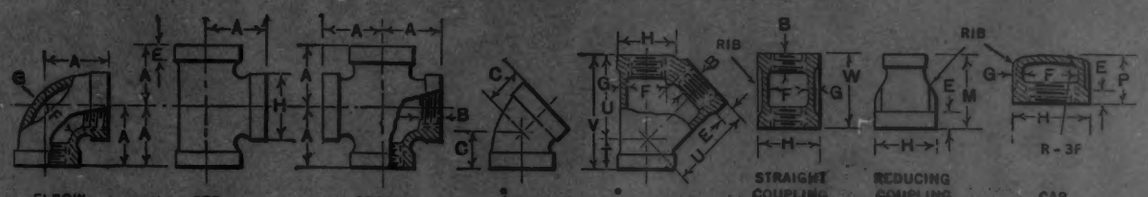
Ten Dollar Prizes
- J. S. Beggs, Volmer, Alberta, Canada.
- C. H. Van Fossen, Akron, Ohio.
- M. L. Hunker, Dover, Ohio.
- Charles L. Heisler, Schenectady, N. Y.
- H. C. Town, Keighley, Yorks, England.
- P. J. McCullough, St. Louis, Mo.
- George L. Nuhn, East Haven, Conn.
- W. J. Gibbs, Brooklyn, N. Y.
- Robert F. Moore, Montpelier, Vt.
- J. W. W. Ow, Pittsburgh, Pa.

In addition to these prize-winning articles, many other descriptions of ingenious, useful mechanical movements have been received, and all will be published during coming months in the Ingenious Mechanical Movements section. This section, which, since June, 1927, has been a regular monthly feature, is invaluable to machine designers, because it includes many of the most effective motions ever devised, and the descriptions and illustrations deal with mechanical principles that frequently are capable of various applications in the design of automatic machines and other mechanical devices differing widely as to type and purpose.

MACHINERY'S DATA SHEETS 169 and 170

MALLEABLE-IRON SCREWED PIPE FITTINGS

For Maximum Working Saturated Steam Pressure of 150 Pounds per Square Inch (Gage)
Approved by the American Standards Association



Nominal Pipe Size	Center to End, Elbows, Tees, and Crosses A	Center to End, 45-deg. Elbows C	Length of Thread, Min. B	Width of Band, Min. E	Inside Diameter of Fitting F Min.	Inside Diameter of Fitting F Max.	Metal Thickness, Min. G	Outside Diameter of Band, Min. H	Center to End Inlet T	Center to End Outlet U	End to End V	Thickness of Ribs*	Length of Straight Couplings W	Length of Reducing Couplings M	Height of Cap P
1/8	0.69	0.68	0.25	0.200	0.405	0.435	0.090	0.593	0.34	0.97	1.31	0.090	0.96	....	.....
1/4	0.81	0.78	0.32	0.215	0.540	0.584	0.095	0.844	0.43	1.19	1.62	0.095	1.06	1.00	.....
3/8	0.95	0.90	0.36	0.230	0.675	0.719	0.100	1.015	0.50	1.43	1.93	0.100	1.16	1.13	.....
1/2	1.12	0.98	0.43	0.249	0.840	0.897	0.105	1.197	0.61	1.71	2.32	0.105	1.34	1.25	.....
3/4	1.31	0.98	0.50	0.278	1.050	1.107	0.120	1.458	0.72	2.05	2.77	0.120	1.52	1.44	.....
1	1.50	1.12	0.58	0.302	1.315	1.385	0.134	1.771	0.85	2.43	3.28	0.134	1.67	1.69	0.134
1 1/4	1.75	1.29	0.67	0.341	1.660	1.730	0.145	2.153	1.02	2.92	3.94	0.145	1.93	2.06	0.145
1 1/2	1.94	1.43	0.70	0.368	1.900	1.970	0.155	2.427	1.16	3.28	4.38	0.155	2.15	2.31	0.155
2	2.25	1.68	0.75	0.422	2.375	2.445	0.173	2.963	1.34	3.93	5.17	0.173	2.53	2.81	0.173
2 1/2	2.70	1.95	0.92	0.478	2.875	2.975	0.210	3.589	1.62	4.73	6.25	0.210	2.88	3.25	0.210
3	3.08	2.17	0.93	0.548	3.500	3.600	0.231	4.285	1.71	5.55	7.26	0.231	3.18	3.69	0.231
3 1/2	3.42	2.39	1.03	0.604	4.000	4.100	0.248	4.848	1.85	6.25	8.10	0.248	3.43	4.00	0.248
4	3.79	2.61	1.08	0.661	4.500	4.600	0.265	5.401	2.01	6.97	8.98	0.265	3.69	4.38	0.265
5	4.50	3.08	1.18	0.780	5.563	5.663	0.300	6.583	2.34	8.43	10.77	0.300	4.22	5.12	0.300
6	5.13	3.46	1.28	0.900	6.625	6.725	0.336	7.767	2.66	9.81	12.47	0.336	4.75	5.86	0.336
8	.....	.....	1.47	1.125	8.625	8.725	0.403	9.995	....	....	.....	0.403	5.75	7.25	.....

*Right-hand couplings have two ribs, and right- and left-hand couplings have four ribs on sizes smaller than 1 inch and six ribs on sizes 1 inch and larger.

MACHINERY'S Data Sheet No. 169, New Series, January, 1930

CAST-IRON SCREWED PIPE FITTINGS

Approved by the American Standards Association

For Maximum Working Saturated Steam Pressure of 125 Pounds per Square Inch (Gage)

Nominal Pipe Size	Center to End, Elbows, Tees, and Crosses A	Center to End, 45-deg. Elbows O	Length of Thread, Min. B	Width of Band, Min. F	Inside Diameter of Fitting P Min.	Inside Diameter of Fitting P Max.	Metal Thickness, Min. G	Outside Diameter of Band, Min. H
1/4	0.81	0.78	0.32	0.38	0.540	0.584	0.110	0.93
3/8	0.95	0.90	0.36	0.44	0.675	0.719	0.120	1.12
1/2	1.12	0.98	0.45	0.50	0.840	0.897	0.130	1.34
3/4	1.31	0.98	0.50	0.56	1.050	1.107	0.155	1.61
1	1.50	1.12	0.58	0.62	1.315	1.385	0.170	1.95
1 1/4	1.75	1.29	0.67	0.69	1.660	1.730	0.185	2.30
1 1/2	1.94	1.43	0.70	0.75	1.900	1.970	0.200	2.68
2	2.25	1.68	0.75	0.84	2.375	2.445	0.220	3.28
2 1/2	2.70	1.95	0.92	0.94	2.875	2.975	0.240	3.86
3	3.08	2.17	0.93	1.00	3.500	3.600	0.260	4.62
3 1/2	3.42	2.39	1.03	1.06	4.000	4.100	0.280	5.20
4	3.79	2.61	1.08	1.12	4.500	4.600	0.310	5.79
5	4.50	3.05	1.18	1.18	5.563	5.663	0.380	7.05
6	5.13	3.46	1.28	1.38	6.625	6.725	0.430	8.28
8	6.56	4.28	1.47	1.47	8.625	8.725	0.550	10.68
10	8.06	5.16	1.68	1.68	10.750	10.850	0.690	13.12
12	9.50	5.97	1.88	1.88	12.750	12.850	0.890	15.47
14 O.D.	10.40	....	2.00	2.00	14.000	14.100	0.880	16.94
16 O.D.	11.82	....	2.20	2.20	16.000	16.100	1.000	19.30

For Maximum Working Saturated Steam Pressure of 250 Pounds per Square Inch (Gage)

Size	A	O	B	E	F	G	H
1/4	0.94	0.81	0.43	0.49	0.540	0.18	1.17
3/8	1.06	0.88	0.47	0.55	0.675	0.18	1.36
1/2	1.25	1.00	0.57	0.60	0.840	0.20	1.59
3/4	1.44	1.13	0.64	0.68	1.050	0.23	1.88
1	1.63	1.31	0.75	0.76	1.315	0.28	2.24
1 1/4	1.94	1.50	0.84	0.88	1.660	0.33	2.73
1 1/2	2.13	1.69	0.87	0.97	1.900	0.35	3.07
2	2.50	2.00	1.00	1.12	2.375	0.39	3.74
2 1/2	2.94	2.25	1.17	1.30	2.875	0.43	4.60
3	3.38	2.63	1.23	1.49	3.500	0.48	5.36
3 1/2	3.75	2.81	1.33	1.57	4.000	0.52	5.98
4	4.13	3.19	1.48	1.74	4.500	0.56	6.61
5	4.88	3.50	1.53	1.91	5.563	0.66	7.92
6	5.63	4.31	1.72	2.24	6.625	0.74	9.24
8	7.00	5.19	1.93	2.58	8.625	0.90	11.73
10	8.63	6.00	2.13	2.91	10.750	1.08	14.37
12	10.00	....	2.25	3.10	12.750	1.24	16.84
14 O.D.	11.00	....	2.45	3.45	14.000	1.33	18.40
16 O.D.	12.50	....	....	....	16.000	1.50	20.88

MACHINERY'S Data Sheet No. 170, New Series, January, 1930

DIAMOND-BORING AUTOMOBILE CONNECTING-RODS

Automatic clamping equipment has reduced the chucking time on a Coulter diamond-tool boring machine used for boring both ends of automobile connecting-rods, to five seconds per rod. The length of the machine cycle is thirty seconds. During this time, the babbitt bearing in the large end of the connecting-rod is bored to 2.374 inches within 0.00025 inch for a length of 1.265 inches, and the bronze bushing in the small end is bored to 1.061 inches within 0.0002 inch for a length of 1.247 inches. The tool-spindles operate at different speeds, one at 4000 and the other at 2000 revolutions per minute. The feed per revolution is 0.0012 inch, and the depth of cut is 0.010 inch.

As illustrated in Fig. 2, each connecting-rod bore is located for the operation by means of a pilot. Then before the diamond tools descend into the bores, the connecting-rod is securely gripped by the overhead automatic clamp. Fig. 1 shows the diamond tools about to enter the connecting-rod bores.

A standard adjusting means provided on the machine, which is built by the Automatic Machine Co., Bridgeport, Conn., makes it adaptable to different lengths between centers of connecting-rods and to bores of various diameters. Both boring-bars are adjustable to 0.0001 inch to permit size variations for selective assembly or for boring replacement parts.

In addition to the high degree of accuracy obtained by diamond-boring, this process has the advantage of eliminating such operations as broaching, reaming, and scraping. Oil-grooves can be cut across without difficulty and without leaving burrs. One manufacturer who diamond-bores connecting-rods reports that the tool cost averages less than 0.1 cent per rod.

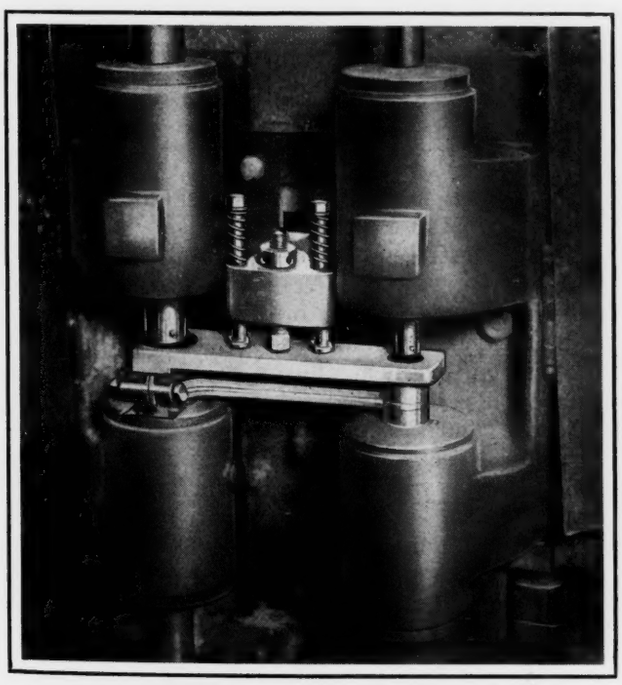


Fig. 1. Automobile Connecting-rod Clamped Ready to have Both Ends Diamond-bored

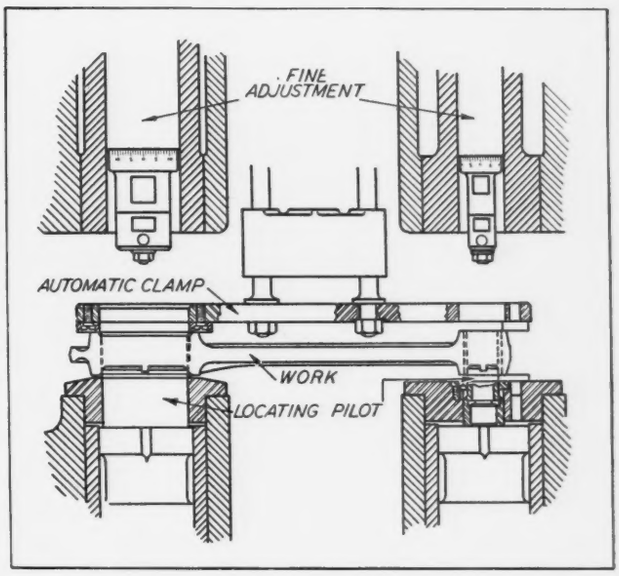


Fig. 2. Method of Locating and Clamping Connecting-rods for Diamond-boring Operation

LIFE OF LUBRICATING OIL

"Does lubricating oil wear out?" Following a given quantity of oil through its various stages of use makes it evident, says *Oil-Power*, that this question should be answered in the negative. Though the oil does lose its lubricating properties, it cannot be said that it wears out. One of the most common factors that contribute to the loss of effectiveness of a lubricant is dirt. The atmosphere is charged with dust, oftentimes caused by operations around the plant. Such foreign matter finds its way to the oil. Closely allied with this foe of lubricating oil are small metal particles that separate from the bearings and are picked up by the oil. Obviously the abrasive action of substances like these reduces the value of a lubricant.

Another factor which tends to shorten the life of lubricating oil is moisture. When oil in a bearing is heated and subsequently cooled, moisture condenses from the air. Regardless of the care taken in packing a bearing, moisture seeps in to do its destructive work. Water, air and heat, in addition to the rapid circulation of the oil, are likely to cause the formation of an emulsion, which in turn produces a sediment or sludge, and here we have another enemy of lubricating oil. The trouble comes from this undesirable substance mainly when it srikes a cold surface. This causes it to precipitate, resulting in its all too frequently clogging pipes.

* * *

The electric lighting for the Chicago Civic Opera House is now controlled by a new method devised by the General Electric Co. Previously the operation of a multitude of switches was necessary to control the 141 individual lighting circuits required. With the new device, these circuits are all controlled by one master knob, and the "lighting director" is in front of the curtain, instead of back stage, close to the prompter and musical director.

What is Ahead in the Automobile Industry?

A Number of Automobile Executives Express Their Opinions as to the Future of the Industry and the Lines along which it will Develop

A NUMBER of leading executives in the automotive industry were asked by MACHINERY to give their opinions as to the business prospects in this field for 1930. The opinions of Alvan Macauley, president of the National Automobile Chamber of Commerce and president of the Packard Motor Car Co., are given in the inserts in the center of pages 346 and 347 in the article "The Business Outlook in the Machinery Industry." There is, therefore, no need of repeating this statement here.

A. R. Erskine, president of the Studebaker Corporation and chairman of the Pierce-Arrow Motor Car Co., expects that within a few weeks after the beginning of the year, production and employment in the automotive industry as a whole will show a substantial increase. "Outside of the Ford business," says Mr. Erskine, "1929 has not been a year of record production for most automobile manufacturers. In view of the fact that so large a part of the Ford production was in response to a demand from a special clientele, which had long been waiting for the new car to be placed on the market, it is not accurate to speak of 1929 as a year of amazing production of automobiles of all classes.

"The 'normal' automobile output is a constantly increasing quantity, because the per capita demand for transportation service is gaining every year in America. Business and residential quarters are becoming more and more widely separated; suburban belts cluster about all our great cities; and the industries are becoming decentralized.

"We look upon 1930 as a year of opportunity and have prepared to meet it. The industry has command of its problems. It has curtailed production and held down inventories at the right time, and the present lull is, therefore, an augury of a large volume of business in 1930. Any prolonged stagnation in the automobile industry is impossible in America."

Mr. Franklin, president of the Franklin Automobile Co., voices much the same opinion. "Automobile and general business volume," says Mr. Franklin, "should reach highly satisfactory levels in 1930. During the first part of the year, the reaction caused by the stock market decline may keep the monthly totals below the corresponding figures for 1929. This condition, however, will wear away quickly because of the demonstrated soundness of established business. The Franklin company is going ahead confidently with a marked increase in advertising appropriations and with expanded sales effort."

It is not expected by James A. Bohannon, president of the Peerless Motor Car Co., that production in 1930 will be as large, in total units, as in 1929, but that fact does not impair the soundness of the automobile industry in the least. "People everywhere," says Mr. Bohannon, "are drawing a parallel between the stock market decline and the decline in automobile sales. The real facts are that the automobile decline started about the middle of August and the stock market readjustment in October. The automotive industry would have had to revise production schedules toward the end of the year even though the market had continued to boom.

"Engineers in the automotive field are going to forget some of the statements in their text-books during the coming years, and under the demands of the hour are going to produce new ideas that will advance the motor car industry. The public is going to get a better automobile, better engineered, better built, more troubleproof. I predict, too, that the public is going to pay a bit more for it."

Mr. Bohannon further points out that the automobile industry has gone through its pioneering, engineering, and mass production cycle, and is now in the beginning of what may be called the "management" stage, which he defines as "the collective ability of the manufacturer and the dealer to produce and market automobiles on a basis that is permanent and profitable to them both."

"The year 1930," says Mr. Bohannon, "may not be a year in which the industry will make the greatest number of automobiles, but it will be a year in which the industry will get its feet firmly fixed on the ground and make its future even more secure in the service that it renders."

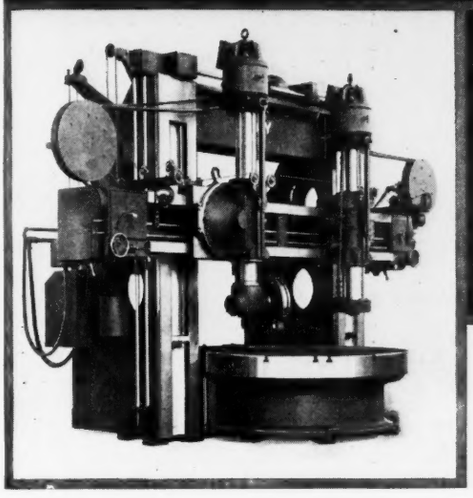
* * *

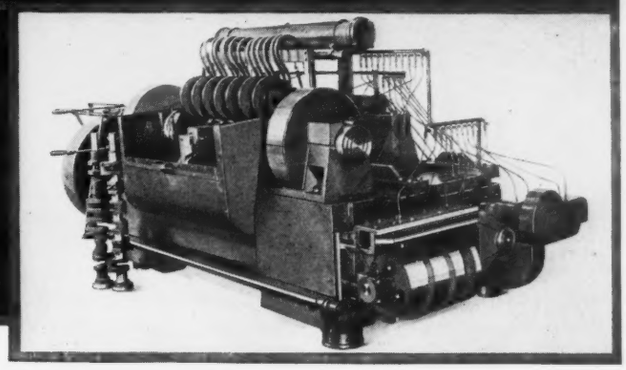
RAILWAY CONVENTION AND EXPOSITION

The annual meeting of the Mechanical Division of the American Railway Association is scheduled to be held in the new Auditorium at Atlantic City, N. J., June 18 to 25. Present indications are that this will be the largest meeting ever held by the Mechanical Division and that it will be attended by the chief mechanical officers of practically every railroad in the United States and Canada. The Purchase and Stores Division of the American Railway Association will hold its meeting at the same time, as will also the Motor Transport Division.

In conjunction with the meeting, an exhibition will be staged under the auspices of the Railway Supply Manufacturers Association. Further information pertaining to the exposition may be obtained from J. D. Conway, secretary-treasurer of the Railway Supply Manufacturers Association, 1841 Oliver Building, Pittsburgh, Pa.

New Shop Equipment





A Record of the Latest Developments in Metal-working Machinery, Small Tools, and Work-handling Appliances

GRAY ROTARY GRINDING MACHINE

Outside and inside cylindrical and conical surfaces, and flat surfaces as well, can be ground on a 108-inch rotary type of machine recently built by the G. A. Gray Co., 3611 Woodburn Ave., Cincinnati, Ohio, for the Chicago Heights plant of the American Manganese Steel Co. From the illustration it will be observed that this machine resembles, in general appearance, a heavy boring mill, with grinding wheels taking the place of boring-mill tools. The right-hand wheel-head of the machine is set up for grinding an inside cylinder and the left-hand wheel-head for a horizontal flat surface. Additional grinding heads may be mounted on the two housings.

Any desired surface speed of the work is available through the wide range of table speeds provided. The table is driven by a five-horsepower variable-speed motor, the speed of which is controlled by a rheostat located above the two hand-levers seen on the right-hand housing. These levers give four mechanical changes of speed in addition to the motor speeds.

Each grinding-head saddle is equipped with a swivel by means of which the spindle ram can be positioned to any angle for grinding outside or inside cones. The spindle rams are ground steel forgings, at the upper ends of which are flanges to which the spindle motors are bolted. Each of these motors is of 25 horsepower rating, and its speed is adjustable from 1000 to 2500 revolutions per minute.

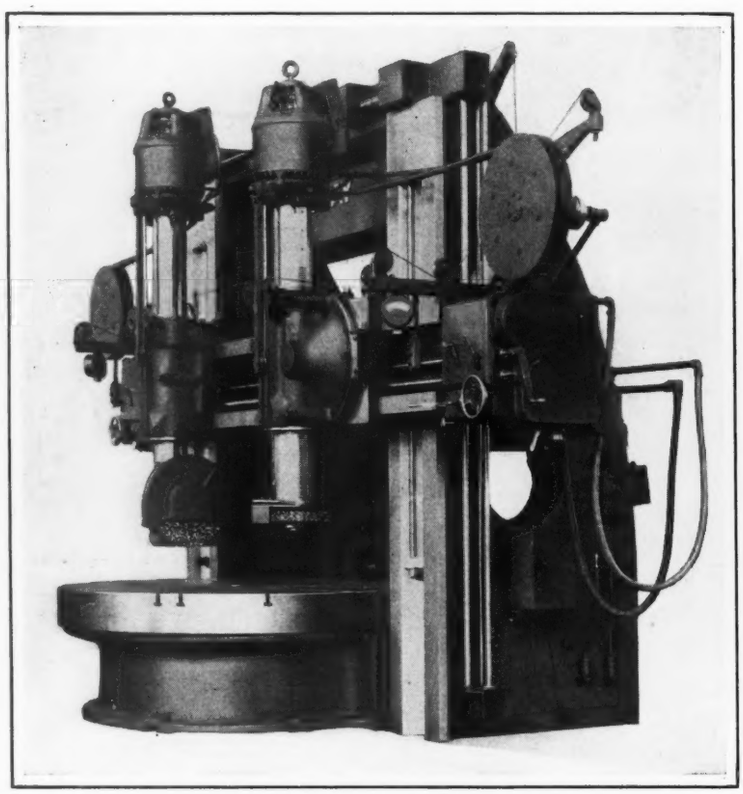
The end of the motor shaft carries a flexible coupling which engages another flexible coupling on the end of the wheel-spindle. The upper end of this spindle runs in a ball bearing, while the lower end runs in a pair of Timken bearings. The spindle is about 6 feet long. The weight of the wheel, ram, spindle, motor, and other attached parts of each spindle-head is counterbalanced.

The right-angle attachment, mounted on the spindle ram of the left-hand head, consists of a cast-iron case carrying a horizontal wheel-spindle which is also mounted in precision bearings. This attachment is driven by a spiral bevel gear on the main spindle. The right-angle attachment is used to grind flat horizontal surfaces only. Various feeds and rapid traverse motions add to the convenience of operation and the production of this machine.

Since the right-hand head is controlled entirely from the right-hand side of the machine and the left-hand head in an identical manner from the left-hand side, the operation of one head only will be considered. The saddle is traversed along the rail by means of a screw which may be turned manually by applying a crank. Directly over this screw is a feed-rod which rotates the rack pinion of the spindle ram by means of a worm drive. By applying a crank to the feed-rod and turning it in a clockwise direction, the ram is fed down, while by reversing the rotation of the crank, the ram is raised.

On the top brace there is a motor and gearing which drives the rapid traverse mechanism. This mechanism is controlled by means of three handles that may be seen projecting from the gear-box at the corresponding end of the rail. One of these handles controls the rapid traverse movement of the saddle along the rail, either toward or away from the operator; the second handle controls the ram movement similarly; and the third handle controls the raising and lowering of the rail.

Within this gear-case are replaceable change-gears for controlling the traverse feed and the in feed of the grinding wheel.



Gray Grinding Machine Built for Finishing Inside and Outside Cylindrical and Conical Surfaces and Flat Surfaces

Two levers on the front of the gear-case are interlocked in such a way that when the traverse feed is connected, for instance, to the feed-rod, the in-feed mechanism is coupled to the saddle screw. The change-gears provide sixteen rates of traverse feed, ranging from 1/4 to 2 inches per revolution of the table, and twelve rates of in feed ranging from 0.00025 to 0.004 inch per traverse. The feed mechanism is so arranged that whenever the ram reaches its lowest or highest position, the in feed becomes operative, the rail screw rotates slightly, and the wheel is moved into the work the desired amount.

In order to limit the motion of the ram in its swivel (or the saddle along the rail) and to reverse the direction of the traverse feed at the end of the traverse, a circular plate is provided which revolves in unison with the movement of the traversing member. On this plate are adjustably mounted two dogs that operate a trip mechanism to start a torque motor that drives a traverse-feed reverse mechanism. Each time that a dog strikes this trip mechanism, the direction of travel is automatically reversed. If the ram is moved above the upper limit of its travel by the rapid traverse, it is automatically returned as soon as the feed is thrown in.

The pieces to be ground in this machine are large and the material is hard and tough. Consequently, the wheels wear so rapidly that the depth of cut at the end of a traverse is only a fraction of the depth at the beginning of the movement. To compensate for this wheel wear, a differential mechanism is incorporated in the in-feed train and driven by a small motor through a speed changing mechanism. By means of a knob projecting from the bottom of the gear-case, this mechanism may be so set that any desired amount of continuous feed can be superimposed on the in feed which occurs at the beginning of each traverse movement.

The grinding wheel motor is provided with an ammeter, which facilitates regulating the compensating feed, as it shows whether the power taken by the motor remains constant during the traverse, thus indicating a constant depth of cut.

Water for each grinding wheel and electrical current for the wheel motor are supplied by a hose and a cable wound on a reel supported above the gear-case on the end of the rail. This reel winds and unwinds automatically as the ram or saddle traverses, a constant tension being maintained by a weight and cable. All the motors can be instantly stopped by pushing any one of a number of emergency push-buttons located at convenient points.

CINCINNATI "HYDROMATIC" MILLING MACHINE

The line of "Hydromatic" milling machines with locked hydraulic table feed, manufactured by the Cincinnati Milling Machine Co., Cincinnati, Ohio, has been extended by the addition of a No. 3-24 machine, which is built in plain and duplex types. This machine is of a size applicable to a large percentage of work in the high-production class. The table has working dimensions of 49 by 12 inches and a travel of 24 inches.

The principal units of the plain machine include a No. 3 bed and table unit, a No. 3 headstock unit, a No. 3 spindle carrier with an over-arm and two arbor supports, a spindle reverse and clutch unit, and a hydraulic feed unit. The plain machine, as well as the duplex type, can be supplied with widened and raised headstocks, close-coupled spindle carriers, a variable-height overhung rail and a bridge-type fixed rail, to meet the requirements of the user.

The spindle carrier unit and the spindle reverse and clutch unit comprise the entire spindle drive. Eight standard spindle speeds are available, ranging from 27 to 200 revolutions per minute. Higher and lower se-

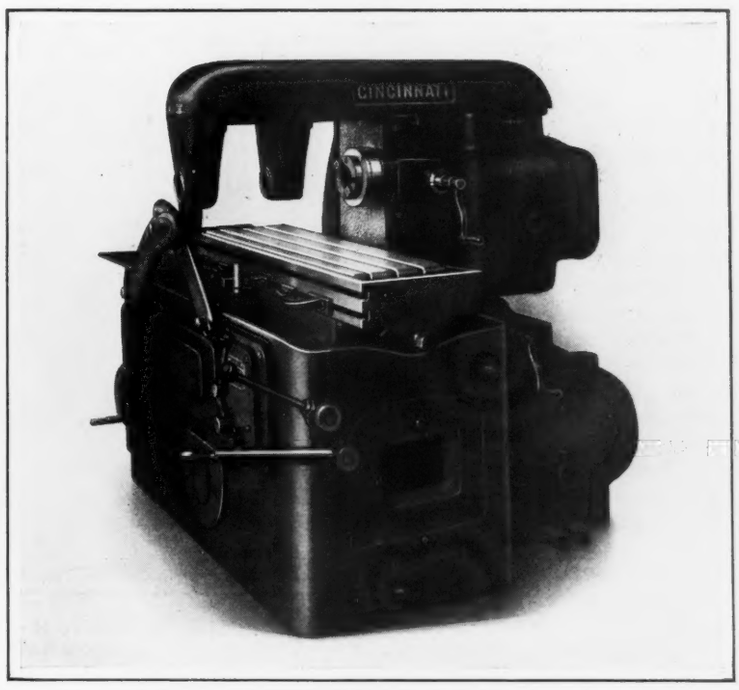
ries of spindle speed change-gears can be supplied. The spindle quill has a cross adjustment of 4 1/4 inches, obtainable by turning a crank. Other adjustments for setting up the machine, such as raising and lowering the spindle carrier, are made from one position at the right of the machine. The bolts on the different units can also be loosened and tightened from one position.

New style over-arm braces supported from the lower end of the outer arbor support and fastened to the sides of the bed, are new equipment. The double mounting of anti-friction bearings incorporated in previous machines both at the front and rear of the spindle has been retained. The entire spindle drive mechanism is equipped with anti-friction bearings, and is automatically lubricated.

The locked hydraulic feed unit is the same as that provided on larger sizes of "Hydromatic" milling machines, and is interchangeable. Hand feed changes are made by shifting a single lever located on the feed unit, any desired feed between 0 and 40 inches per minute being obtainable. An automatic variable feed to suit different widths or depths of cuts is available through the use of an attachment that may be fastened to the bed at the right of the hydraulic feed unit and adjacent to the headstock.

All operating levers are conveniently located. One lever is used for starting and stopping the spindle. Just above it is another lever that controls the direction of the table feed and has four positions. The nature of these positions depends upon whether the machine operates on a one-way or a two-way cycle. A one-way cycle machine has a feed to the left and a quick traverse left and right at the rate of 300 inches per minute. There is also a stop position for the control lever.

Two-way cycle machines have two positions for feed and two for power quick traverse. Plain machines are supplied with either one-way or two-way feed cycles, while duplex machines are built only with the one-way cycle. A third lever located at the side of the bed starts and stops the table movement without affecting the table cycle.



Cincinnati "Hydromatic" Milling Machine with a Table Having Working Dimensions of 49 by 12 Inches

Automatic control of all table movements, including intermittent feeds, is obtained through the use of new type reversing dogs on the side of the table, which operate a new style of trip plunger having an oscillatory and reciprocating movement that controls the hydraulic feed mechanism. The reversal time of any milling cycle has been considerably reduced to permit shorter feeding strokes to be used and higher production rates to be obtained.

The pulley bracket and reverse box unit are automatically oiled by the splash system, while the spindle carrier unit is automatically lubricated by a pump in that unit. One-shot lubrication is provided for other parts of the machine. A system can be provided for supplying coolant to the cutters at the rate of 20 gallons per minute. The net weight of the plain machine is 5500 pounds, and of the duplex machine, 6500 pounds. The same machine can also be supplied with a table having 30 inches of travel, in both plain and duplex types weighing 7500 and 9000 pounds, respectively.

MELLING CRANKSHAFT TURNING AND CHEEKING LATHE

A machine designed for simultaneously rough-turning the bearings and facing the cheeks of crankshafts having either seven or nine bearings has recently been brought out by the Crankshaft Machine Co., 320 N. Jackson St., Jackson, Mich. The particular machine illustrated is intended for use on Franklin crankshafts which have seven bearings.

The crankshaft is held at the ends by chucks *A*, Fig. 2, which are mounted on spindles driven through spur gears by a shaft at the front of the machine. At the rear of the machine there is a table carrying seven tool-blocks *B*, each of which has two cheek-facing tools and one bearing-turning tool. This table is fed forward by means of a cam drum on the right-hand end of the ma-

chine, simultaneously advancing all tools to the work. In the drive to this drum, there is a simple feed-box, which is essentially a reverse mechanism for use in case some abnormal condition develops.

It will be seen that each tool-block *B* is equipped with a roller *D* to support the pressure of the cut. The tool-blocks are pivoted, and as they feed into the work, the rollers come in contact with the tops of the bearings being turned. The pressure of the cut tends to rock the tool-blocks down, but this is prevented by the rollers.

There is also a steadyrest which engages the center bearing of the crankshaft. This steadyrest consists of a pivoted bar *E*, at the upper end of which there is a link carrying a roller that engages the crankshaft center bearing. At its lower end this pivoted bar contacts with a roller on the end of a rod extending forward from the table on which the tool-blocks are mounted.

The steadyrest does not come into action until the cheek-facing operation has been completed and the turning of the bearings is about to start. Then the table advances the rod, and the roller at its forward end rocks bar *E* to move the steadyrest roller forward into firm contact with the work. This provision eliminates any possibility of the tool pressure springing the work out of shape. It is not necessary, with this machine, to spot a bearing for the steadyrest before starting the machining operations. On seven-bearing crankshafts, the operations are completed in about five minutes, floor-to-floor time.

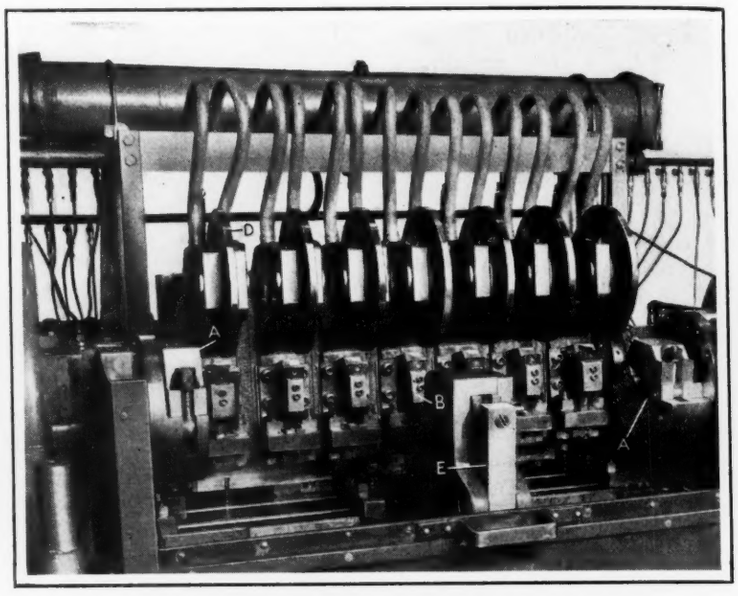


Fig. 2. Close-up View of the Seven Tool-blocks and the Pressure-taking Rollers and Steadyrest

RIVETT INTERNAL-EXTERNAL GRINDING MACHINE

Both internal and external grinding operations can be performed in a No. 104-5 turret type of precision grinder recently developed by the Rivett Lathe & Grinder Corporation, Brighton

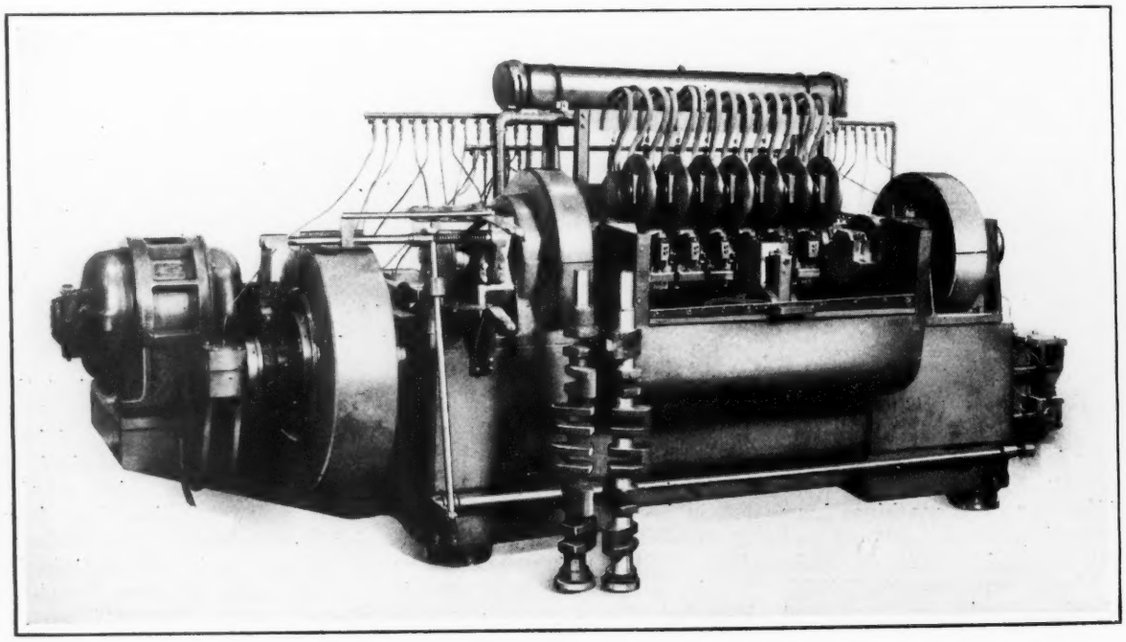


Fig. 1. Melling Lathe which Rough-turns the Bearings and Faces the Cheeks of Seven-bearing Crankshafts

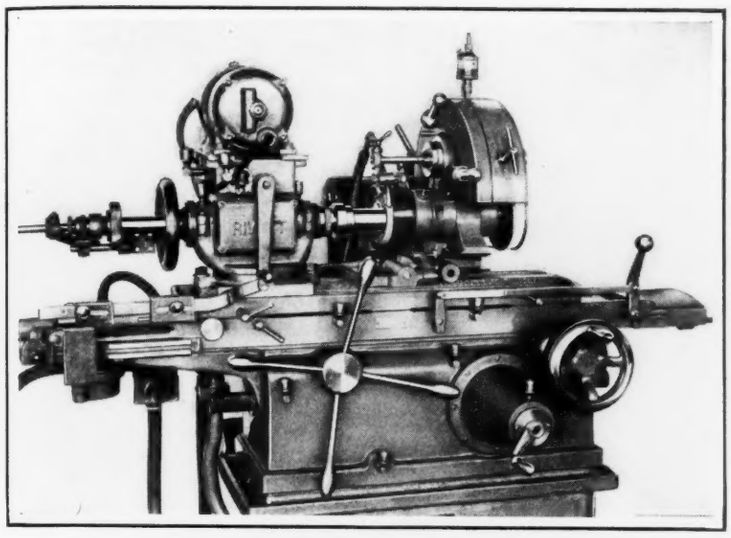


Fig. 1. Rivett Turret-type Grinding Machine with External Grinding Spindle in Position for Use

District, Boston, Mass. In the turret are mounted external and internal grinding-wheel spindles, either of which can be quickly indexed into position for use. Fig. 1 shows the external grinding spindle in position for finishing a part, and Fig. 2 shows the wheel of the internal grinding spindle being fed into the work.

This machine is motor-driven, the work-head receiving power from an individual motor mounted on it, while a main drive motor at the back of the machine supplies power for reciprocating the table, driving the water pump, and driving the grinding spindles. Reciprocation of the table is through the Rivett heart-cam movement, which insures rapid and convenient adjustment for length of stroke. The power table reciprocation is engaged by means of the ball-end handle at the right-hand end of the table, while the feed of the grinding wheel is controlled through the graduated cross-slide handwheel. The machine is furnished with an automatic headstock stop and start, and an automatic water-control.

This equipment is particularly designed for setting up and grinding small work of a wide variety rapidly and accurately. The two-spindle turret, which is mounted on the cross-slide, permits the internal and external grinding of parts concentrically with one chucking. The external grinding wheel is carried on a slow-speed spindle, and the internal grinding wheel on a high-speed spindle. Both spindles are driven by the pulley seen at the back of the machine in Fig. 3, through a removable endless canvas belt, which is applied to the particular spindle to be driven. While one spindle is being used, the other spindle is at rest, thus avoiding unnecessary vibration and danger from a free-running wheel.

The turret is conveniently indexed through the use of a spring-loaded indexing pin with pull-out handle, which is located at the front of the turret housing. Fig. 3 shows the operator engaged in indexing the turret.

"RED-E" BALL-BEARING LIVE CENTER

The high speeds employed in taking full advantage of the new cutting tool materials have practically necessitated the use of anti-friction bearings in the work-centering devices of many machines. The edges of cutting tools made from these materials are very sensitive to chatter or vibration, and therefore the live center must provide a rigid and non-deflecting support for the work. With the view to meeting these requirements, the Ready

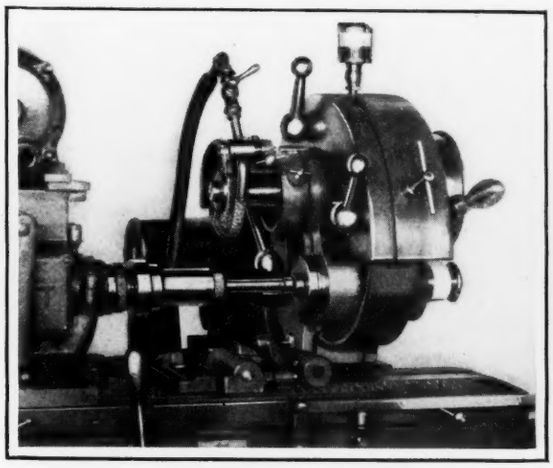


Fig. 2. Internal Grinding Spindle in the Grinding Position

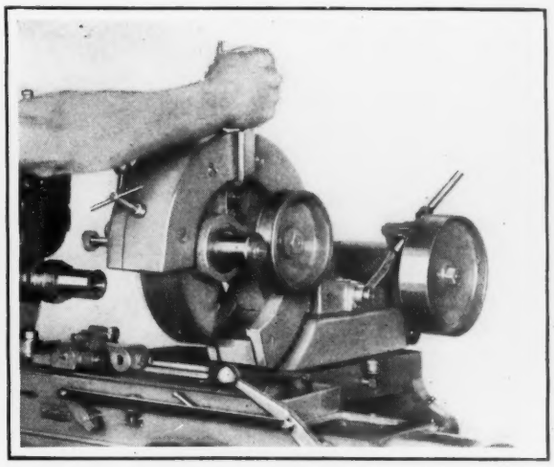
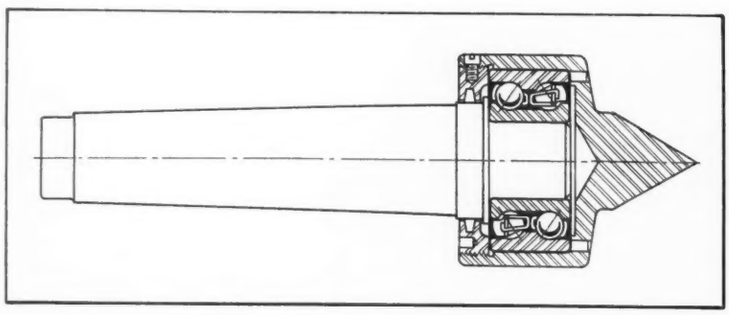


Fig. 3. View Showing Drive Pulley and Manner of Indexing the Wheel-spindles



"Red-E" Live Center Designed to Permit High-speed Rotation of Work

Tool Co., 550 Iranistan Ave., Bridgeport, Conn., is now placing on the market the tailstock live center shown in the illustration, which is equipped with a New Departure double-row ball bearing. This angular contact bearing has solid high-carbon chromium-steel inner and outer races, and is so assembled that the two rows of balls are opposed in a definitely preloaded condition.

When this center is set up in a machine, the work is supported close to the tailstock proper, so that the inherent rigidity of the bearing is not offset by deflection of other parts, which would result if there were considerable overhang. The housing closure or seal is located on the side opposite the work, and therefore is protected from the direct force of the cutting compound. Also, the rotating housing helps to keep lubricant in the bearing, and at the same time, throws compound and chips away from the bearing seal.

The bearing is so mounted that the outer race rotates with the nose or point of the center. The nose is ground after assembly on the bearing, with a view to making it run dead true. Since the nose rotates with the work, regrinding is not often required. However, when necessary, regrinding may be done readily without removing the center from the machine. This is accomplished by driving the nose through a belt placed around the bearing housing and taking a cut with a small grinder adjusted to the angle of the nose. The ball bearing requires no attention for lubrication or adjustments of any kind from the user.

This center is now manufactured in the taper sizes most used, but tapers of any type or size can be provided to order.

IMPROVED FEATURES OF FELLOWS GEAR SHAPER

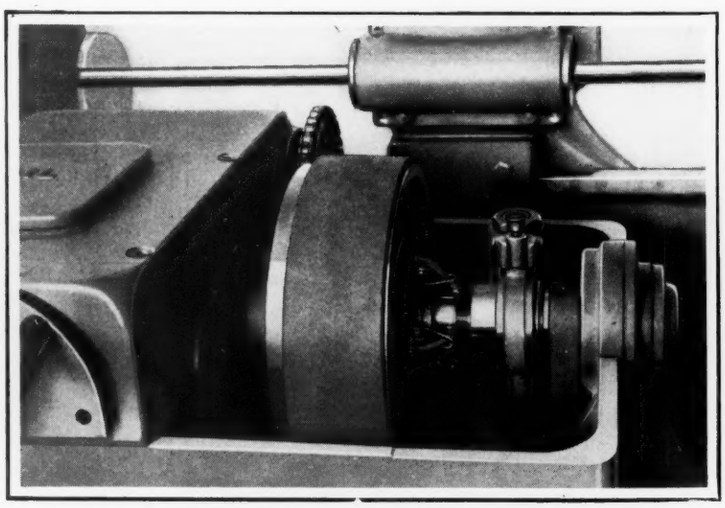
Several improvements have recently been made in the 6A type gear shaper built by the Fellows Gear Shaper Co., 78 River St., Springfield, Vt., which was described in December, 1928, MACHINERY, page 300. The improvements are intended to simplify the machine from the operating standpoint. One of the features consists of a friction disk clutch and a single-pulley drive, as illustrated. This equipment is completely enclosed on the machine by a hinged guard, which is not shown. Incorporated in the single-pulley drive is a disk brake located on the main drive shaft, which enables the operator to stop the travel of the cutter at any desired point. This feature is found especially convenient in setting up the machine.

Another change that is particularly convenient when the machine is being used for production work is the provision of an opening in the cabinet through which the entire compound tank can be thoroughly cleaned at intervals of all chips. A removable plate has been provided on the top of the stroke gear-box to facilitate filling the oil reservoir.

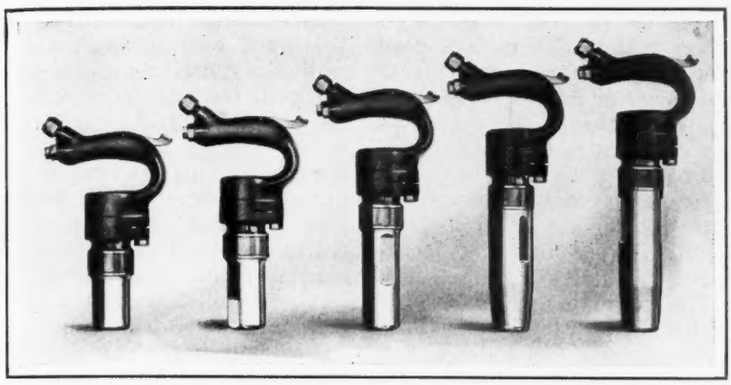
Another convenient addition is a bracket that is attached to the right-hand end of the gear shaper to hold all wrenches and tools used in the operation of the machine. The motor bracket is of a simpler design than formerly. The capacity of the machine remains the same as before.

INGERSOLL-RAND HIGH-SPEED CHIPPING HAMMERS

In the high-speed pneumatic hammers recently placed on the market by the Ingersoll Rand Co., 11 Broadway, New York City, a plate valve of the flapper type is used, which gives several important advantages. The flapper valve, being a thin deflated plate, permits the hammers to be made of short length and light weight. The valve flaps down on its seat, without a sliding move-



Single Pulley Drive with Friction Disk Clutch now Provided on 6A Type Fellows Gear Shaper



Ingersoll-Rand High-speed Pneumatic Chipping Hammers with Flapper Type Valves

ment, to close the air ports, and rises to open them. This action gives quick full opening and closing of the ports, which is said to result in unusual power and speed. It is claimed that the valve practically does away with valve maintenance problems.

The throttle valve is of a combination piston and poppet type which gives a fine graduation of port opening and remains tight over a long period of service. Open-type handles are standard on the hammers. The handles screw on the barrels, and are locked in place by a pinch-bolt arrangement. The exhaust is through the side of the barrel and can be deflected in any direction. These hammers are made in five sizes having a stroke of 3/4, 1, 2, 3, and 4 inches, respectively. They are intended to meet all conditions encountered in chipping and calking.

CINCINNATI PLUNGE-CUT AND BRAKE-DRUM GRINDING MACHINES

A semi-automatic plunge-cut grinding machine embodying in its construction a special adaptation of the center-type principles of grinding to units usually employed in centerless grinding has been developed by Cincinnati Grinders Incorporated, Cincinnati, Ohio. The framework of the No. 3 centerless grinder serves as a basic unit about which the machine is built. However, in place of the regulating or feed wheel used on centerless grinders, an extended spindle arranged as shown in Fig. 1 is employed as a work-arbor. Parts similar to clutch facing rings, transmission stub shafts, disks of various types, brake-shoes, etc., are mounted on a hollow mandrel that is placed on the spindle. A bayonet lock is provided to secure the mandrel quickly.

The movement of the work-slide toward the grinding wheel is cam-controlled. By operating a single hand-lever at the front of the machine, the work is revolved and fed into the grinding wheel. The cam controlling this movement is so arranged that the work advances rapidly to the wheel and then proceeds at a slower rate until ground to the correct diameter. A short period of time is allowed for a complete "rounding up" action, and then the work recedes rapidly from the grinding wheel and the rotation of the arbor stops. All this action is automatic.

The in-feed work-slide is arranged for a reciprocation up to 3/8 inch maximum, and also for an up-and-down oscillation, an individual motor driving the reciprocating and oscillating units. A cam controls the oscillation, while the desired amount of reciprocation is obtained by an eccentric arrangement on the trunnion. All these movements are automatic, a single movement of the lever at the front of the machine starting the cycle of feeding, oscillating, reciprocating and backing away.

The machine is driven by a built-in motor of 40 horsepower rating, and is equipped with a grinding wheel 24 inches in diameter by 10 inches wide. A chain drive transmits power from the motor to the grinding wheel spindle, although a "Texrope" drive is sometimes supplied as an alternative.

Work up to 15 1/2 inches in diameter can be accommodated, and the width of the grinding wheel provides for handling a large number of parts in one

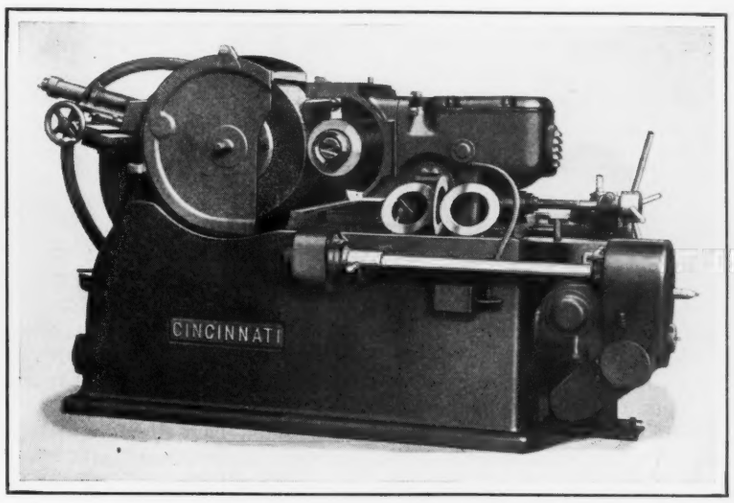


Fig. 1. Cincinnati Plunge-cut Grinder Designed for Grinding Parts Supported on an Extended Spindle

grinding cycle. In grinding clutch facing rings, sixty parts are mounted on the mandrel and two mandrel loads are ground to size per minute, which means a production of 6000 pieces per hour, allowing for unavoidable loss of time. For truing the grinding wheel, a Ross type dresser is provided. The grinder may also be arranged with centers and a work driver to handle certain classes of work.

Improvements over previous brake-drum grinding machines built by this company are incorporated in the model shown in Fig. 2, which is also being introduced to the trade at this time. One of the new features is a fully guarded grinding wheel which insures more safety for the operator. The guard is a steel casting and is removable. It has a slip-off cover on top, which gives easy access to the wheel for truing.

Another improvement lies in mounting the grinding wheel spindle in anti-friction bearings. The grinding wheel may now be brought into the work the required distance by power, as well as by hand, by employing an independent in-feed attachment driven by a fractional horsepower motor. There is a dead stop arranged for use with either the power or hand in feed. Sizing by means of the dead stop is sometimes facilitated through the use of a dial gage which is permanently located in contact with the surface being ground. A micrometer indexing mechanism facilitates close settings.

The grinding-wheel truing equipment includes a Ross dresser, which is mounted on top of the wheel-head and is operated by a hand-lever after the slip-off cover has been removed from the wheel guard. An independent valve supplies a stream of coolant for wheel dressing. An improved moto-driven coolant pump of vertical type is mounted on the rear of the machine. The rotor of this pump is located below the level of the coolant supply tank, which makes priming unnecessary.

This machine has a capacity for swinging work up to 26 inches external diameter, thereby enabling wheel and drum assemblies to be handled as well as unmounted drums. Inside diameters up to 22 inches can be ground on mounted drums.

Mechanical reciprocation of the work over a short stroke while the grinding wheel is automatically fed into the work keeps the ground surface free from wheel marks and insures a smooth braking surface on the drum. The reciprocating motion also decreases the number of truings required and reduces the manual labor. This movement is air-controlled through a valve conveniently located. The mechanism embodies a cam-operated reciprocator driven from the headstock work-spindle.

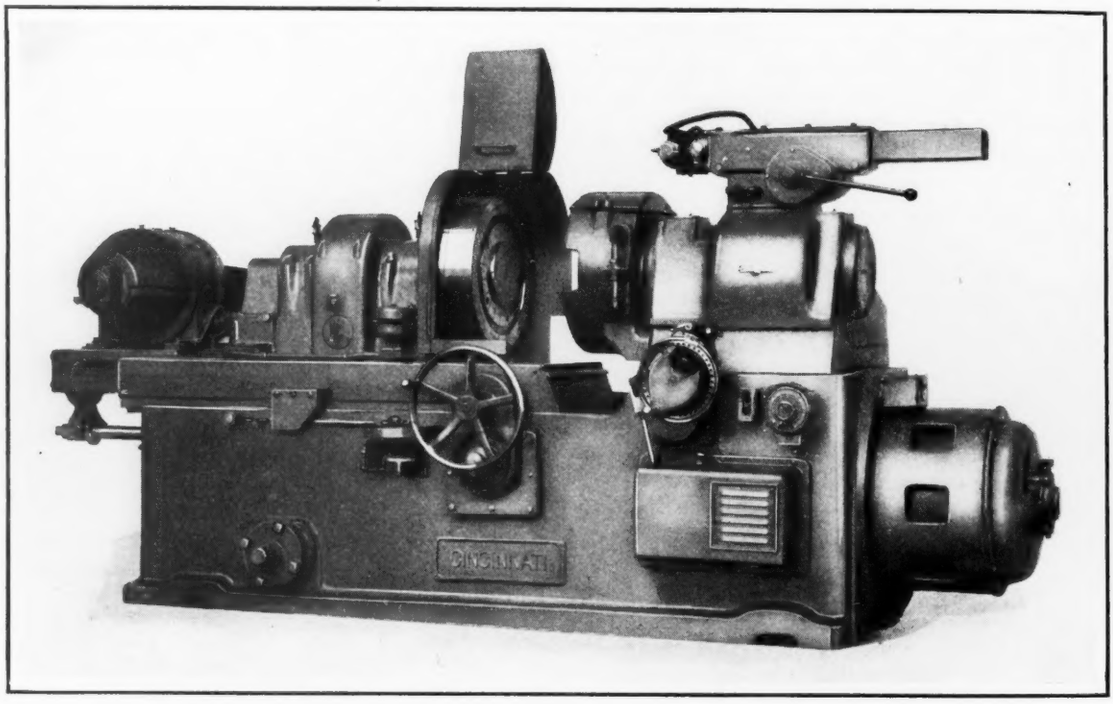


Fig. 2. Cincinnati Brake-drum Grinding Machine which has Important Improvements over Previous Models

The machine operates on the plunge-cut principle, and since the diameter of the grinding wheel is within approximately 2 inches of the diameter being ground, a soft-face cutting wheel can be used.

The grinding wheel is driven by a 40-horsepower motor built into the machine, and the work-head by a 5-horsepower variable-speed direct-current motor. A generator on the bed supplies 230-volt direct current to the headstock motor. A rheostat controls the various feeds of the work. There is a third motor which supplies the power in feed to the wheel-head.

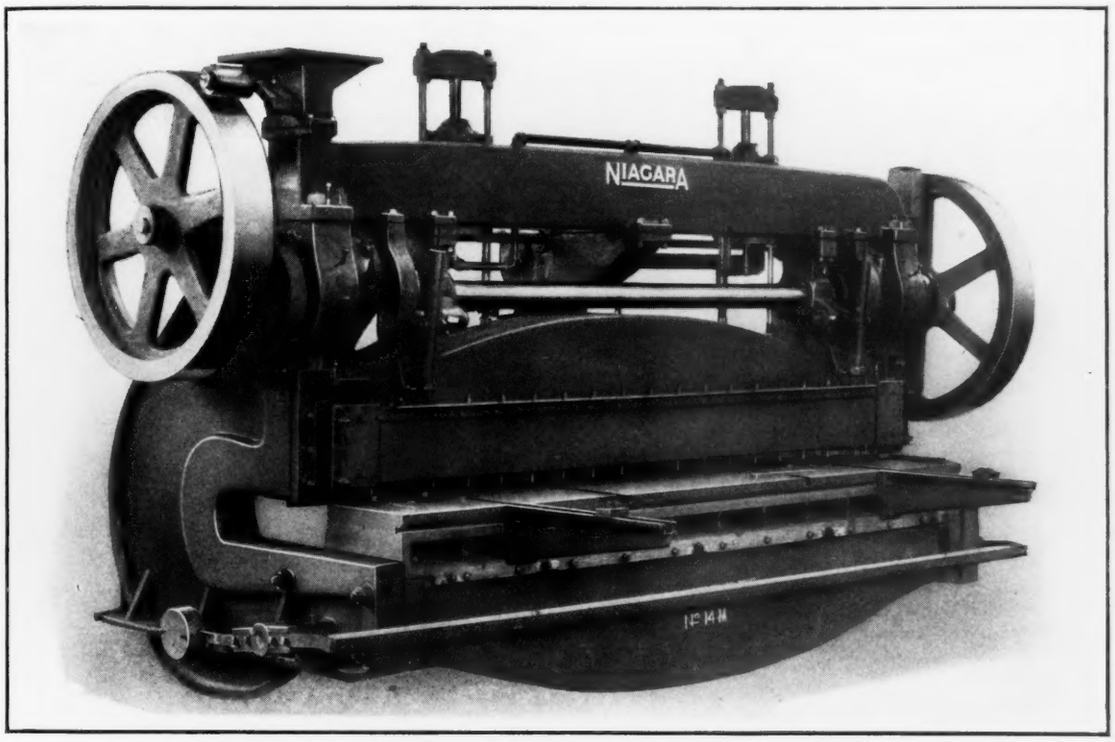
NIAGARA HEAVY-DUTY SQUARING SHEARS

Improved features have recently been added to the Series M line of heavy-duty mill squaring shears built by the Niagara Machine & Tool Works, 637-97 Northland Ave., Buffalo, N. Y. The shears of this line have capacity for cutting mild steel plate from 1/2 to 3/4 inch, and they are built in lengths of from 60 to 192 inches. The main eccentric shaft of each shear is made with the eccentrics forged solid. The main bearings in the housings and the center bearings lie immediately adjacent on either side of the eccentrics and hold-down cams. These bearings have been arranged close together with a view to stopping vibration, resisting deflection, and minimizing bending stresses.

The Niagara patented individual spring foot hold-down has been incorporated in these machines. This hold-down is operated by two cams located on the main shaft. Toggle links transmit the hold-down pressure stresses directly to the housings, thus relieving the cams, main shaft, and main-shaft bearings of heavy vertical stresses. Each foot is self-adjusting for short and long plates and for different thicknesses of material.

The cross-head is counterbalanced by two pneumatic cylinders mounted on the crown, although provision is made for counterbalancing by means of springs or weights in installations where compressed air is not available. The lower knife chuck is adjustable from front to back. A positive-jaw clutch, provided with three engaging surfaces, controls the motion of the cross-head.

Shears of the M series are double-geared, and all gears have generated teeth to give quiet and smooth operation. A belted or geared motor drive can be applied, the belted motor drive shown in the illustration being recommended.



Niagara Power Squaring Shear Arranged for an Individual Belted Motor Drive

MORSE COBALT STEEL DRILLS

"Circle C" cobalt steel drills intended for use in cutting metals too hard for high-speed steel drills are now carried in stock in a large range of sizes by the Morse Twist Drill & Machine Co., New Bedford, Mass. Drills made with Morse taper shanks are regularly carried in sizes of from 1/8 to 1 1/2 inches, while drills having straight shanks are carried in sizes of from 1/8 to 1/2 inch.

POWER QUICK TRAVERSE FOR CINCINNATI M TYPE MILLING MACHINES

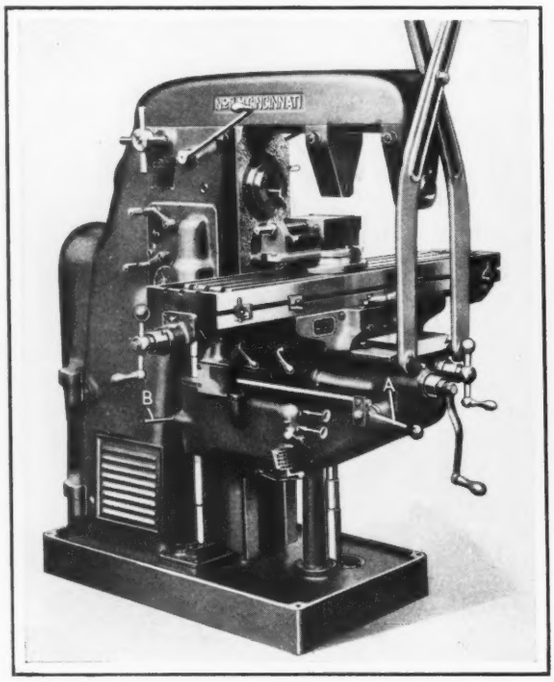
The Nos. 1 and 2 plain, universal, and vertical styles of M type milling machines manufactured by the Cincinnati Milling Machine Co., Cincinnati, Ohio, are now equipped with a power quick traverse in six directions, that is, up and down, in and out, and left- and right-hand. The rates of this traverse are 100

inches per minute longitudinally, 66 inches crosswise, and 33 inches vertically. The power quick traverse movements are obtained by operating a lever on the left-hand front side of the knee, as shown at *A* in the illustration.

To obtain the power quick traverse in a given direction, it is only necessary to engage the respective feed-lever, move the reversing lever into position, and then pull lever *A* upward. As long as the power quick traverse is wanted, lever *A* must be held up, which is a valuable safety feature, as the quick traverse cannot be engaged accidentally.

To feed in the same direction as the power quick traverse being used, lever *A* is merely moved into the lowest position, where a detent is provided to hold it in place. Twelve feeds are available from 3/4 to 30 inches per minute longitudinally, from 1/2 to 20 inches crosswise, and from 1/4 to 10 inches vertically in both directions. When lever *A* is placed horizontally, it is in neutral.

Rear control of any of the three feed movements can be obtained by operating the rear reversing lever *B*, which is a duplicate of the standard lever at the front of the gear-box.



Cincinnati M Type Milling Machine with Power Quick Traverse in Six Directions

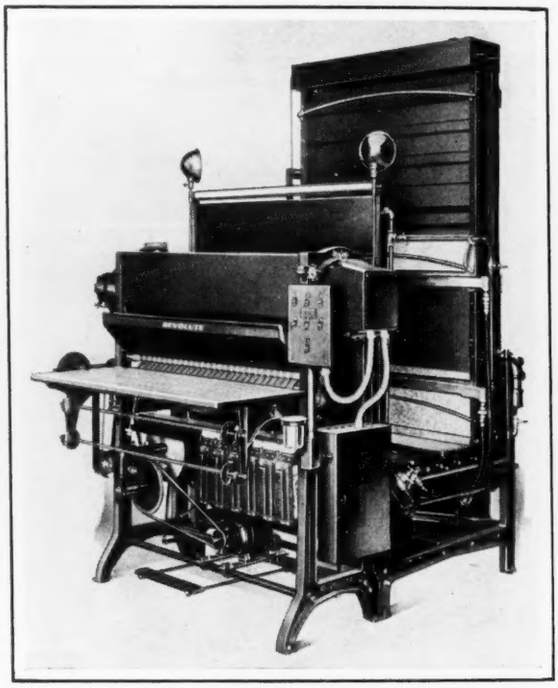


Fig. 1. Revolute Blueprinting Machine Operating at Speeds of from 3 Inches to 20 Feet per Minute

REVOLUTE AUTOMATIC BLUEPRINTING MACHINE

The principal features of a No. 3E blueprinting and finishing machine built by the Paragon-Revolute Corporation, 77 South Ave., Rochester, N. Y., include a revolving Pyrex glass cylinder with lamps inside; a hot-air extractor; a speed control; a 10-foot bath; a dual chemical reservoir; a submerged chemical pump; an open-type heater; and an automatic compensator.

Tracings are laid right side up on the continuous roll of paper, and carried into the machine by an automatic roll feed, and then upward and around the cylinder. By this method, the prints are exposed to both sides of a bank of Pyrex globed arc lamps inside the cylinder. It is claimed that by passing the prints around both sides of the lamps the printing speed is accelerated considerably. The tracings are held in contact with the cylinder by narrow endless bands whose tension is automatically controlled and constant unless released by a treadle.

Ventilation of the machine is obtained by means of a squirrel-cage type of centrifugal suction blower, such as shown in Fig. 2, which is placed directly against one end of the cylinder. Air from the room is sucked through the cylinder and forced outside through a stack or window, as desired. This arrangement ventilates the room in addition to keeping the temperature of the machine and printing surface low, approximately 700 cubic feet of air being drawn through the machine per minute and exhausted out of doors. All tracings fall into a receiving tray without attention on the part of the operator.

Correct timing for every kind of print is obtained by means of a variable-speed device which is controlled at the left of the feeding leaf through a handwheel equipped with a dial. Speeds varying from 3 inches to 20 lineal feet per minute are in-

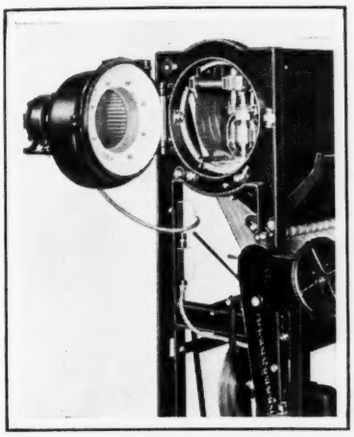


Fig. 2. Exhaust Fan which Draws Heated Air from the Cylinder

stantly available without gear or rheostat changes.

In the washing and potashing portion of the machine, the paper is under development for a distance of over 10 feet. The first clear-water bath consists of a combination of flood and spray washes, both vertical and horizontal. The potash bath is applied in large quantities while the paper is in a horizontal position, and flows over its entire width. From the paper, the chemical flows directly into the reservoir, no mechanical take-off being required. The dual chemical reservoir permits hypo as well as potash solution to be retained ready for use at all times. The paper is treated to either potash or hypo for a distance of about 4 lineal feet and is then thoroughly washed in clear water, after which the paper passes into a dryer.

The dryer is of the baffle-oven type which provides a large evenly heated area and allows the paper to pass through the heat rather than simply over it. It is claimed that this arrangement greatly reduces any possibility of distortion. The dryer is equipped for heating either by gas or electricity. The dried prints may be rolled up in a loose roll or run on a trimming table. The automatic compensator insures that the speed of the washer and dryer conveying rolls is always in direct relation to that of the printing section.

This blueprinting and finishing machine is manufactured in two widths, of 42 and 54 inches, and is equipped for operation by either direct or alternating current. The floor space required, front to back, is 7 feet 6 inches. The width of the 42-inch machine is 6 feet 3 inches, and that of the 54-inch machine, 7 feet 3 inches.

THOMAS COLUMN FACING MACHINE

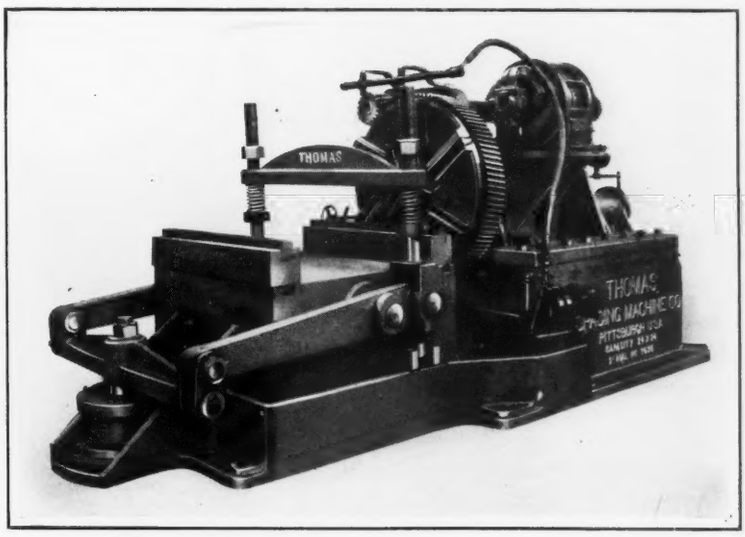
A steel-column facing machine which embodies new and improved features is being introduced to the structural trade in several sizes by the Thomas Spacing Machine Co., 811 Fulton Building, Pittsburgh, Pa. Except for the air supply, the machine is an entirely self-contained unit. The particular machine illustrated has a cutter-head 40 inches in diameter, and will face up to 24 inches square. A double-headed machine having one head stationary on the foundation and the other movable on rails may be provided for facing both ends of columns simultaneously to accurate lengths.

Rapid setting up of work and a secure gripping action are provided by the use of an air clamp. The swinging arrangement of this clamp allows work to be lowered on the bed and the clamp to be swung over it. An Oilgear feed actuates the cutting mechanism and provides an unlimited range of feeds to suit the columns handled. For production work, a plate is provided on which may be marked the various positions of the control lever for different feeds on various materials. Another graduated plate is equipped with a movable stop, which may be set to stop the carriage automatically at any predetermined point. This plate is adjustable to take care of blade wear due to grinding.

The cutter-head is driven through a helical gear which is cut directly on the head itself. The head is supported by a heavy forged shaft mounted in Timken tapered roller bearings. Bearings of the same kind are also supplied for all other shafts on the machine.

A new arrangement of the cutting blades results in a shear cut. This method is said to have diminished the load on the head approximately 75 per cent, and has resulted in a fast and clean cut, with minimum vibration. Nine blades are employed, and these may be replaced with an extra set in five or six minutes. A grinding jig permits a complete set of blades to be resharpened in a few minutes.

All motor control equipment is mounted on the machine at the operator's station. The standard equipment includes a motor-driven coolant pump.



Machine for Facing Steel Columns, Made by the Thomas Spacing Machine Co.

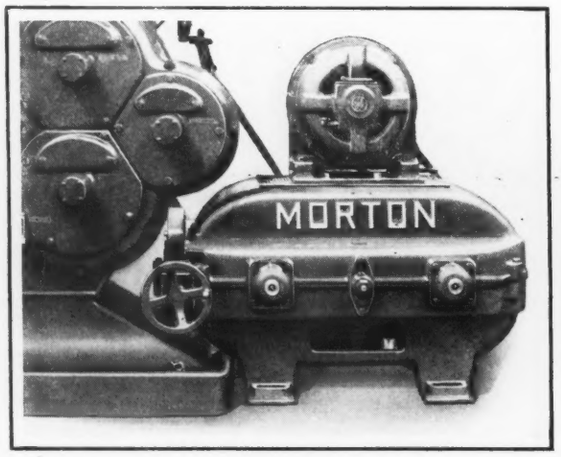


Fig. 1. Morton Variable-speed Transmission Applied to Draw-cut Shaper

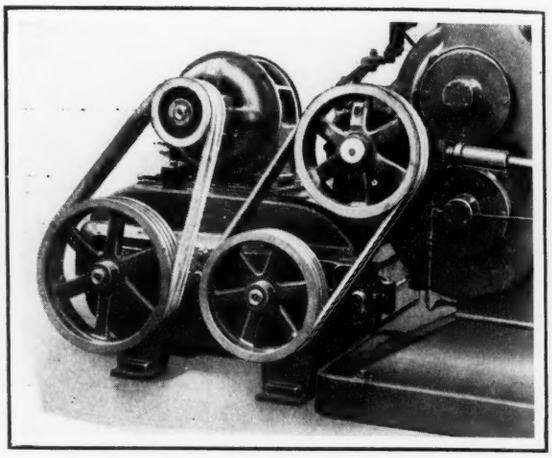


Fig. 2. View of the Morton Variable-speed Transmission Unit from the Left

MORTON DRIVE UNITS

A variable-speed transmission recently produced by the Morton Mfg. Co., East Broadway and Hoyt St., Muskegon Heights, Mich., is shown in Figs. 1 and 2. This drive unit is especially applicable to the high-duty draw-cut shapers built by this concern, but it can also be applied to other types of motor-driven machine tools. It gives an unlimited number of speed changes, and it is possible to obtain a three-to-one speed range. Speed changes can be made while the machine is in motion by merely turning a handwheel located within easy reach of the operator. The cutting speed, in feet per minute, is shown on an indicator which is within view of the operator at all times; however, the feed can be changed in inches. A Reeves unit comprises part of this transmission.

Fig. 3 shows a Morton stationary keyway cutter equipped with a direct-connected reversing drive unit. This unit has been designed particularly for application to the type of machine mentioned, which is built in sizes having cutting strokes of 18, 24, 38, and 48 inches. The unit is of box type construction and embodies multiple disk clutches so geared as to give a two-to-one quick return ratio. It is self-lubricating, the clutches running in oil. The shafts are mounted in Timken roller bearings.

The reversing drive unit eliminates the countershaft and belts previously furnished with this type of machine. It is direct-connected to the machine by means of a flexible coupling, is quiet running, and is positive in its reversal.

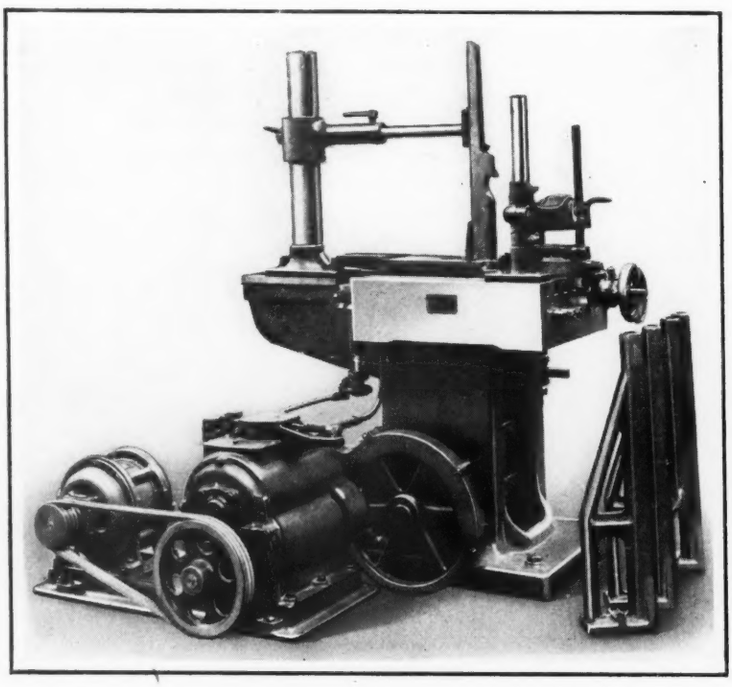
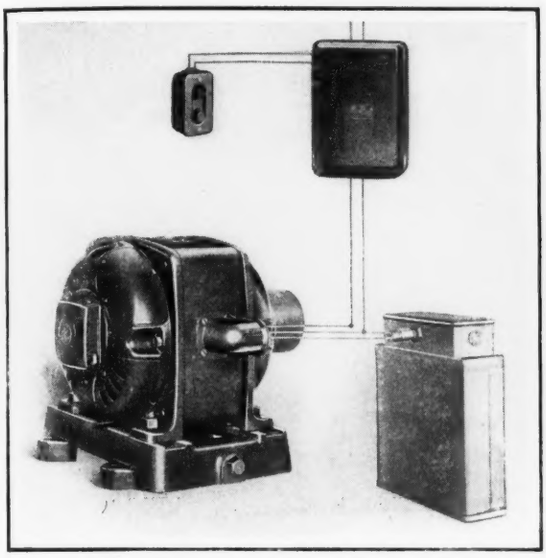


Fig. 3. Morton Stationary Keyseater with Direct-connected Reversing Drive

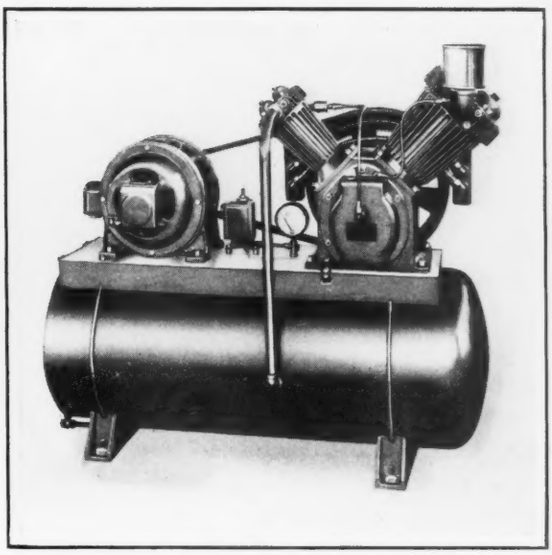
GENERAL ELECTRIC CAPACITOR MOTORS

A line of single-phase squirrel-cage capacitor motors designed especially for quiet operation are being placed on the market by the General Electric Co., Schenectady, N. Y., under the designation of Type KC. These motors are expected to find their principal applications in driving machine tools having the motor built into the machine, blowers and ventilating fans, low-torque centrifugal machinery on low-pressure pumping installations, woodworking machines, etc.

Although the motors are classified as being single-phase, they are really of the modified



General Electric Single-phase Squirrel-cage Capacitor Motor



Ingersoll-Rand Self-contained Small-size Air Compressor

two-phase squirrel-cage type, with a capacitor in series with one phase of the stator windings. This makes the motor self-starting. The capacitor remains in the circuit throughout starting and running, so that full-voltage hand or magnetic control only is required. As a result of this, single-phase pulsation is absent.

The new line includes motors from 1 to 25 horsepower, inclusive, running at a constant speed of 3600, 1800, 1200, or 900 revolutions per minute.

INGERSOLL-RAND AIR-COOLED AIR COMPRESSOR

The line of Type 30 air-cooled two-stage air compressors recently brought out by the Ingersoll-Rand Co., 11 Broadway, New York City, includes four sizes of 3/4, 1 1/2, 3 and 5 horsepower ratings. These compressors are provided with a V-type belt drive. The units are self-contained, the motor and compressor being mounted on a steel base attached to the top of the air receiver. The latter is made to withstand a working pressure of 200 pounds per square inch.

The intercooler is located behind the fan-type flywheel. A constant current of circulating air is driven directly across the cooling coils to reduce the temperature of the discharged air. An automatic start and stop control is furnished as standard equipment. This control operates independently, but in conjunction with the unloader. When the pressure in the air receiver reaches a point at which the regulator is set to unload, the motor is automatically shut off. A centrifugal governor allows the air in the high-pressure cylinder and intercooler to exhaust through the crankcase. This prevents the compressor from starting against a load.

B. & S. DEPTH GAGES

A No. 614 graduated-rod depth gage and a No. 617 combination drill-point and depth gage are

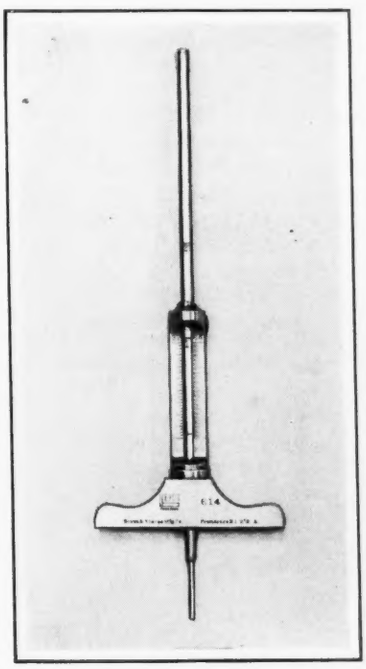


Fig. 1. Brown & Sharpe Depth Gage with Graduated Rod

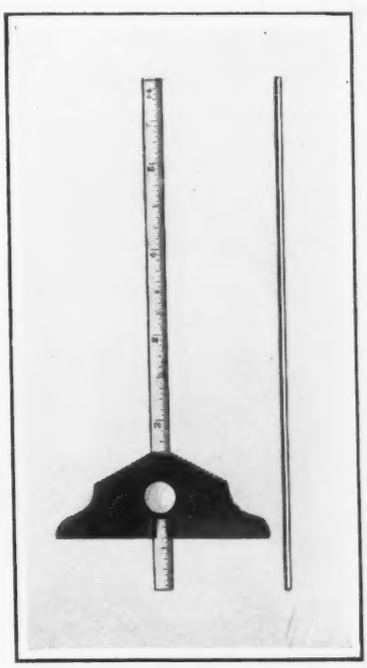


Fig. 2. Combination Drill-point Gage and Depth Gage

being introduced to the trade by the Brown & Sharpe Mfg. Co., Providence, R. I. By means of the graduated-rod depth gage, which is shown in Fig. 1, depths of from 0 to 3 inches can be read directly in sixty-fourths of an inch from graduations on the gage body. The wide base and slender rod make this tool convenient for measuring holes of large or small diameters. The rod is graduated each inch for 3 inches. The first 5/8 inch length of the rod is 1/16 inch in diameter and the remainder is 1/8 inch. The base is 2 inches wide by 1/4 inch thick.

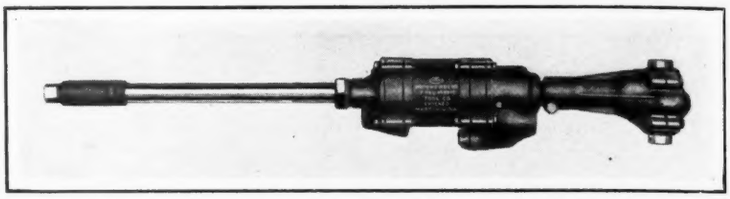
The drill-point and depth gage, shown in Fig. 2, can be used for checking the angles of drill points when grinding them and for determining whether each point is central. It can also be used to find the depth of holes as small as 3/32 inch in diameter and up to 5 inches deep.

The bevels on the head are ground to 59 degrees. These bevels are graduated. The 6-inch rule is also graduated in thirty-seconds and sixty-fourths of an inch. The rod is 5/64 inch in diameter. This gage is also made with graduations to suit the metric system.

TUTHILL VARIABLE- AND REVERSIBLE-FLOW PUMP

A motor-driven variable- and reversible-flow pump of the construction illustrated is being placed on the market by the Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill., to meet the requirements of machine tool builders and other manufacturers operating assembly and test floors. This pump provides a convenient portable unit which is particularly adapted both for filling gear-boxes with oil during tests and for withdrawing the oil afterward. To withdraw the oil, the flow is reversed through the pump without reversing the rotation of the motor. This pump can also be used for flushing gear-boxes with kerosene after a running-in test and for withdrawing the liquid by reversing the flow.

The capacity of the unit when handling lubricating oil is 10 gallons per minute with a speed of 1200 revolutions per minute.



"Thor" Rotary Pneumatic Wrench for Removing Caps from Locomotive Staybolts and Doing Similar Work

"THOR" ROTARY PNEUMATIC WRENCH

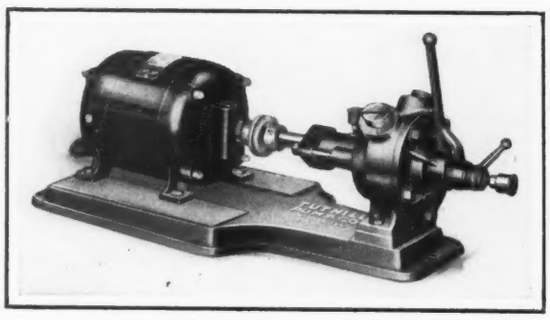
A rotary wrench, known as the "Thor 278," which operates at a speed of 170 revolutions per minute has been added to the line of air-driven equipment made by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. The speed of this wrench is governor-controlled. Heavy-duty ball bearings are used at all vital points of the construction. A renewable rotor liner saves the cylinder from excessive wear and reduces upkeep costs. The weight of the wrench is approximately 40 pounds.

This wrench is particularly useful for such operations as removing the caps from flexible staybolts of locomotive boilers, there being usually from 600 to 750 such caps on a locomotive. In one shop, where it formerly took two boilermakers and two helpers eight hours to remove the caps by hand, only one boilermaker and his helper, with the aid of the wrench, were able to do the entire job in six hours. The device has power enough to remove the caps after they have become rusted in place.

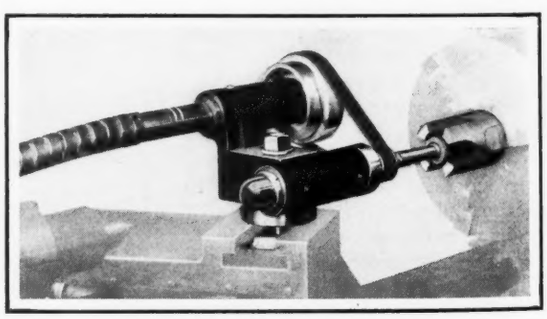
Because of its fast starting torque, the wrench loosens nuts from cylinder studs without backing the studs out. Dome nuts, superheater units, and frame bolts can also be handled with the wrench.

HASKINS FLEXIBLE-SHAFT TOOLPOST GRINDER

Flexible-shaft equipment, the spindle of which may be fitted with various attachments for mounting on the compound rest of a lathe, the ram of a shaper, the rail head of a planer, etc., has recently been brought out by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill. The illustration shows a lathe application in which the spindle of



Tuthill Pump Designed for Filling Units with Oil and Withdrawing It



Use of Haskins Toolpost Grinder on an Internal Grinding Operation

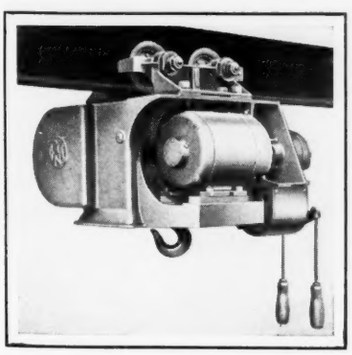
the flexible shaft equipment is provided with an internal grinding attachment.

External grinding operations in a lathe are performed with the spindle mounted on the compound rest also, but a different attachment is employed. Both cylindrical and face grinding can be accomplished with the external attachment.

This toolpost grinder, which is known as the No. HL-5, is fastened to a pedestal designed to suit the average height of lathes. The spindle is equipped with ball bearings and is driven through the flexible shaft by a 1/3-horsepower motor. The motor operates at a speed of 1750 revolutions per minute and drives the flexible shaft through a two-speed countershaft. Two speeds of 3400 and 5100 revolutions per minute are available with the external grinding attachment, and four speeds of 7400, 11,000, 14,300 and 21,200 revolutions per minute, with the internal grinding attachment.

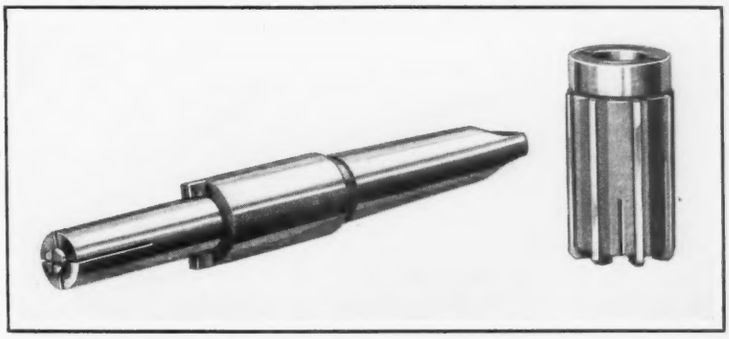
ROBBINS & MYERS ELECTRIC HOISTS

Electric hoists ranging from 1/8 to 7 1/2 tons capacity are being introduced to the trade by Robbins & Myers, Inc., Springfield, Ohio. These hoists have been improved in design to give a saving in weight and in space, including the head room. The cast-steel trolley provided is adjustable to suit nine sizes of I-beams. Another feature comprises a safety enclosed bottom block which keeps the rope on the sheaves and so shrouds all parts as to guide itself easily into the rope flare when swinging. The gearing is made of alloy steel and heat-treated.



Robbins & Myers Electric Hoist Made in Sizes of from 1/8 to 7 1/2 Tons

Hyatt roller bearings are incorporated in the construction of these hoists. The main frame is made of "Aremite" alloy metal, which is produced by the electric process. This metal has a tensile strength of 35,000 pounds per square inch, and is said to withstand shocks more readily than cast iron. The hoist is given an aluminum finish to provide an attractive appearance and protect it from exposure.



Conradson Shell Reamer and Arbor which can both be Expanded

CONRADSON EXPANSION SHELL REAMER AND EXPANSION ARBOR

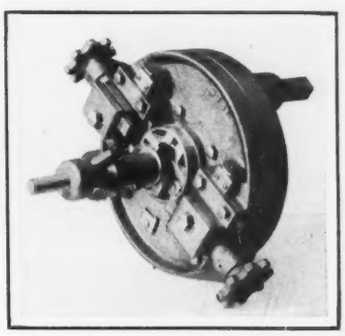
An expansion reamer and an expansion arbor intended for use with this reamer or with other standard reamers have recently been added to the products of the Conradson Tool Co., 2111 Indiana Ave., Chicago, Ill. The reamer is made up of high-speed steel blades and a body of tough alloy steel. Means are provided for expanding the reamer from 0.015 to 0.025 inch, which is said to give a life from six to twelve times that of solid-type reamers.

Expansion of the reamer is accomplished by adjusting a tapered plug in the forward end of the arbor; this plug has a threaded end which engages a tapped hole in the arbor in back of the tapered seat provided for the expanding portion of the plug. The arbor is split similarly to the reamer to permit of expanding both when the tapered plug is adjusted.

A driving key at the back end of the arbor surface on which the reamer is seated engages a keyway in the back of the reamer. Since the expansion plug does not extend beyond the reamer body, it is possible to ream to the bottom of blind holes without interference. The arbor is made of standard dimensions for use with solid shell reamers as well as those of the expansion type.

"BEAVER" GROOVING TOOLS FOR "VICTAULIC" JOINTS

Pipe from 1/2 to 16 inches can be grooved on the end to take "Victaulic" couplings, by means of a line of "Beaver" grooving tools manufactured by the Borden Co., Warren, Ohio. There is a small No. 12 tool which is designed for hand operation only, on pipe from 1/2 to 2 inches and which comprises a means of both grooving and cutting off. This tool cuts a groove that conforms to the contour of the pipe

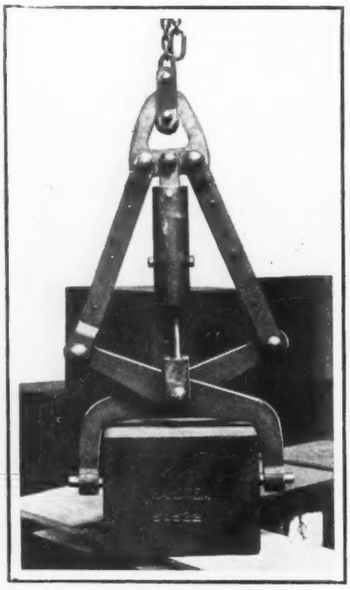


"Beaver" Tool Designed for Cutting Grooves in Pipe to Take "Victaulic" Joints

end, but this is not considered a disadvantage in the small sizes of pipe. The equipment may also be used as a square-end pipe cutter.

Grooving tools for 2-inch pipe and larger are locked on the pipe by means of an internal chuck and cut grooves that are circular, regardless of the fact that the pipe itself may be out of round. The illustration shows the design of the Nos. 20 and 50 tools intended for pipe from 2 to 7 inches, inclusive. A threaded bolt passes through the center of the tool, and over this bolt is placed a double-ended cone. On either side of this cone are four links which are expanded by the cone when the bolt is tightened, producing a gripping action that holds the tool rigidly in the pipe. The groove may then be cut by hand or power operation, at a bench, in a ditch, or elsewhere. One man can operate the tool easily, although it would probably be more satisfactory to use the "Beaver" power drive.

The largest grooving tools, Nos. 120 and 160, for pipe from 8 to 16 inches, are equipped with a different type of internal locking device. Two men are required to place these tools on the pipe, but one man can readily operate them. However, the use of a "Beaver" power drive is recommended.



Gellert Automatic Safety Tongs Operated by a Crane-man Alone

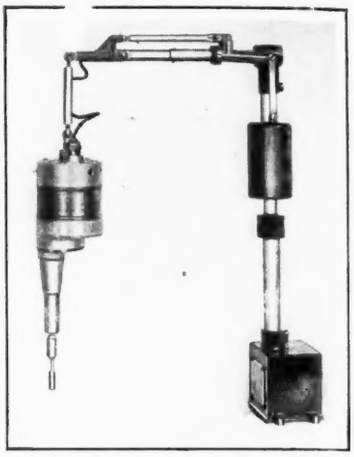
GELLERT AUTOMATIC SAFETY TONGS

The automatic safety tongs shown in the illustration may be suspended from any kind of hoist by a single rope and manipulated by means of this rope only and by the crane-man alone, without requiring any auxiliary men, power, or appliances. These tongs are manufactured under Gellert patents by the Heppenstall Knife & Forge Co., Pittsburgh, Pa. Normally, the tongs are suspended in the open position, and a single down and up movement causes them to grip a load. A subsequent down and up movement makes them release the load, leaving the tongs open, ready to grip another part.

These tongs eliminate all but possibly one ground man in connection with the operation of a crane. This man may, in some cases, have to prepare the load so that the tongs will have access to it, but he does not need to manipulate or handle the tongs except in cramped quarters, where he may have to guide them. The device is positive in action, and of unusually simple design, as the latch contains only two moving parts. No springs or counterweights are contained in the construction and no lubrication, adjustment or other attention is required. The tongs are suitable for handling die-blocks, molds, hot or cold steel ingots, etc., and baled or boxed supplies.

RAY ELECTRIC SCREWDRIVER

Small machine and wood screws can be driven into parts, nuts can be set, and similar operations performed by means of an electric screwdriver unit made by the Ray Machine Co., 5403 W. Lake St., Chicago, Ill. This unit consists of a motor, clutch, and tension device, and is suitable for application to various types of mounting. In the illustration, it is shown attached to a counterbalanced swinging bracket, the horizontal arm and vertical standard of which are adjustable to meet various conditions. The base serves also to house a transformer when the available electric current is other than 110 volts. The vertical arm from which the screwdriver unit is suspended is universal in its movements.

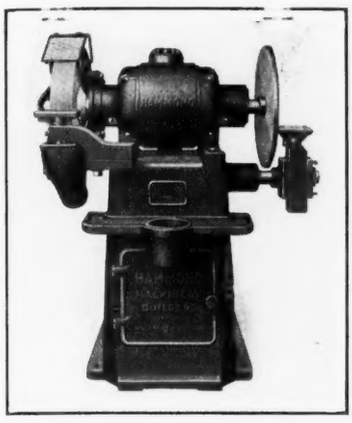


Ray Electric Screwdriver Mounted on a Counterbalanced Bracket

This concern also makes a trolley type mounting, which is especially suitable for assembly operations carried on along moving conveyors or for operations where the location of the screws in the work changes constantly. The trolley track is made of heavy-gage sheet steel, and is designed to deliver current to the motor without the necessity of trailing cords. The screwdriving unit is suspended from the trolley by means of a ball-bearing swivel, and the trolley itself is equipped with ball bearings. In addition, the unit is mounted on knife-edge bearings and is counterbalanced, so that it follows the hand of the operator with little effort. Several screwdriving units can be installed on one track without additional wiring.

HAMMOND COMBINATION DISK AND PRODUCTION GRINDER

A combination disk and production grinder of the construction illustrated is now manufactured by Hammond Machinery Builders, Inc., 1604 Douglas Ave., Kalamazoo, Mich., in four



Hammond Machine Designed for Both Disk and Solid-wheel Grinding

sizes of 2, 3, 5, and 7 1/2 horsepower capacity. It is built in both alternating- and direct-current types, and is intended for installation in shops where disk grinding operations are limited, the solid grinding wheel being always available for grinding tools or castings. A plain table, as shown, is provided as standard equipment, but a universal lever-feed table can be furnished if desired. The machine can also be fitted with disks and tables of either type on both ends.

Like all grinders built by this concern, this machine is equipped with a patented device that supplies clean air to the motor windings. The machine is provided with a push-button control and an automatic motor starter having protection against thermal overload, low voltage, and phase failure. This starter is mounted on the inside of the pedestal door where it can be inspected and reset conveniently.

Ball bearings designed and mounted to take both radial and lateral thrusts are provided. There are liberal oil reservoirs equipped with oil-cups, an oil level gage, and a drain plug. Any surplus oil will overflow away from the motor windings. The disk is machined on both sides so that two abrasive members can be mounted on the disk at one time. After one member has been worn, the disk can be quickly reversed.

"CLOUDBURST" AUTOMATIC HARDNESS TESTING AND SUPERHARDENING MACHINE

An automatic motor-driven machine is now built by the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., for performing the "Cloudburst" method of hardness testing or for producing a superficial layer of intense hardness on any metal, including the hardest steel. The principles involved in performing these hardness tests and in producing the superhardness were described in an article published in November, 1928, MACHINERY, page 213.

The new 12-inch machine is rated to deliver 500,000 blows per minute on work by employing 250,000 balls, 1/8 inch in diameter. These balls are raised by means of a chain elevator to a height of 4 meters (13.123 feet) and then allowed to drop through a tube or chute of rectangular shape until checked by a piston. This piston is movable up and down within the chute to provide for dropping the balls on the work from various heights, as required. The slide and scale on the machine facilitate locating the piston.

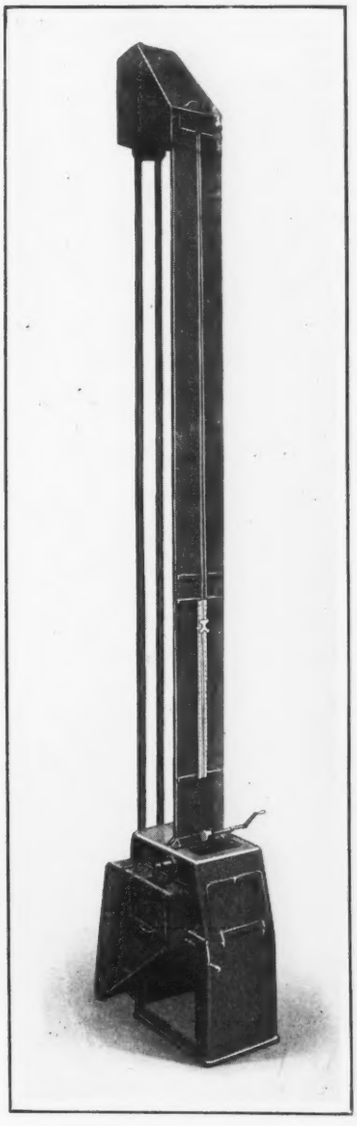
In the bottom of the piston there is a slot through which the balls drop, falling down the chute and on the work in a curtain or stream 12 inches long by 1 inch wide. The table on which the work is placed is located within a rubber-lined chamber. It is reciprocated automatically across the curtain of balls, so that the entire surface of every article placed on the table, is subjected to an intense bombardment for either the hardness test or the superhardening process.

For handling cylindrical work, the machine is provided with a rotating spindle having a tapered hole in which a mandrel for holding gears, bushings, etc., can be fitted. Gears are tested in gangs, and are set off the center of the shower so that the balls fall on the faces of the teeth.

The chain conveyor that carries the balls to the top of the rectangular chute passes up one of the small-diameter tubes seen at the rear of the machine and returns down the other tube after discharging the balls. The machine has a net weight of 2000 pounds. It can also be arranged with a belt drive instead of a motor drive.

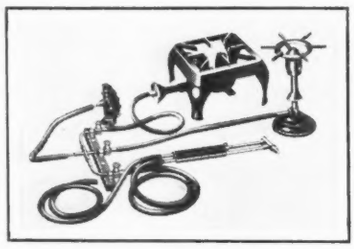
"PREST-O-LITE" INTENSE HEAT PRODUCING EQUIPMENT

Laboratory apparatus for producing intense heat, such as is required in experimental and re-



Automatic Motor-driven "Cloudburst" Machine

search work, is being placed on the market by the Prest-O-Lite Co., 205 East 42nd St., New York City. A flame hot enough to melt various metals can be produced



"Prest-O-Lite" Laboratory Equipment for Producing Intense Heat

with this apparatus, and the flame can be easily controlled. As shown in the illustration, the equipment consists of a hot plate, a Bunsen burner, an acetylene-and-air torch with air control, a reducing valve, a three-way branch valve, red-gum tubing, and a small tank of dissolved acetylene. It is stated that the flame produced with dissolved acetylene is non-oxidizing and non-carbonizing. The flame can be changed from the brush type to an intense needle point by adjusting the air supply. The brush flame has a temperature of about 2800 degrees F., and the needle point flame, a temperature of about 3300 degrees F. The instruments and utensils comprising this outfit are easily kept clean due to the absence of soot and smoke.

"CECOLENE" VAPOR DEGREASER

A vapor bath process for degreasing metals and other materials has been developed by the Carrier Engineering Corporation, 848 Frelinghuysen Ave., Newark, N. J. In this process, a solvent known by the trade name of "Cecolene" is boiled and vaporized. In the standard tank form of apparatus used, the vapor rises to the level of water-cooled condenser coils located around the sides of the tank near the top, where it is condensed and precipitated to the bottom of the tank. Since the vapor is more than three times as dense as air, there is no tendency to overflow or escape.

Parts to be degreased are suspended in the vapor, which condenses on their cold surfaces at once and runs off profusely, carrying the grease with it. The parts are kept in the vapor until they become heated to its temperature, which requires from 1 1/2 to 3 minutes, depending on the gage or weight of the metal. They are then removed in a warm, dry and clear state, any foreign matter that remains being in the form of easily removable dust.

The work being degreased does not come into contact with grease previously removed from parts, since the solvent vaporizes at a temperature much lower than the grease. The chlorinated solvent can be used over and over. Vapor degreasing outfits are to be made in standard dip tank units and in special designs adaptable to conveyors used in line assemblies. They will be made to be heated by steam, gas, or electricity.

"KANT-SLIP" PLIER

When the jaws of an improved plier, recently brought out by the Kant Slip Plier & Tool Co., 6036-38 Wentworth Ave., Chicago, Ill., are placed on a nut, bolt, pipe, or other object and pressure is applied, the part is wedged between the jaws through the action of a sliding fulcrum and a sliding cam. The locations of the fulcrum and the cam are indicated in the illustration. This plier can be used for turning parts in close quarters, such as a pipe located against a wall or lying on a floor. For gripping small parts, the pawl seen in

"Kant-Slip" Plier of Recently Improved Design

back of the cam is swiveled forward into contact with the slanting side of the cam. The plier pieces are made of chrome-molybdenum steel and hardened.

TIME TO EXAMINE SHOP EQUIPMENT

This is the time to examine the equipment of the shop and to determine which machines and tools need to be replaced in order that the shop may be ready to handle efficiently the new peak load of business that is sure to come. Wherever business is not now as rushing as it was in the early part of 1929, the opportunity should be grasped to rehabiliate the shop equipment.

In every machine shop, it would be a wise thing to make a list of all the machines that could and should be replaced. Orders could then be placed for new equipment to be delivered in from three to six months. In that way a well equipped shop would be ready for efficient manufacturing when business again moves toward the next peak. One machine tool builder has already made such a survey in his own plant and has found it advisable to place orders for about $150,000 worth of machine tools.

This is a good policy. It helps to stabilize industrial activity and employment, and those who order their new machines now will be ready to go ahead when the next rush in business comes along. It is also a good time to look into the shop methods used —some of them usually can be improved to advantage.

POWER AND ENGINEERING EXPOSITION

It may be said without exaggeration that the National Exposition of Power and Mechanical Engineering held in the Grand Central Palace, New York City, December 2 to 7, was the most comprehensive industrial display ever held in that famous building. All records of attendance were broken, it being estimated that approximately 125,000 people visited the exposition. There were 450 exhibits, indicating the steady growth of the exposition. One of the interesting features was the evidence of the strides made in the automatic control of power equipment.

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

London, December 18

Since the last report a lull in demand has been noticeable in some branches of the metal-working industries. However, this is regarded as temporary and another spurt is expected after the Christmas and New Year holidays.

The Machine Tool Industry is Experiencing a Slight Lull

Although machine tool orders have fallen off to some extent of late, the conditions prevailing generally in the industry may still be regarded as satisfactory. Some machine tool makers will doubtless be glad of the opportunity of catching up on work, so that they may be able to give earlier delivery dates for new business, while the majority are so well placed that the present lull in demand will necessitate no curtailment.

Probably the most interesting new machine of which particulars have become available during the past month is a thread grinding machine built by Harry F. Atkins, Old Fletton, Peterborough. On this machine the required form of the thread is imparted to the grinding wheel by means of a pantograph mechanism from a master profile made twenty-five times the actual size of the thread profile. The various moving parts of the machine, with the exception of the wheel-spindle, are driven by means of a Pelton wheel and centrifugal pump. Actually two opposed Pelton wheels are employed to permit of driving the main shaft in either direction.

Overseas Trade in Machine Tools

During October, exports of machine tools amounted to 1410 tons valued at £175,248, as compared with 1137 tons, valued at £150,615, in September, and 1437 tons valued at £200,693 in August. If we consider the returns for the first ten months of the present year, we find that exports have shown a downward tendency in both tonnage and value since January. However, the year is still well ahead of any since 1921, so far as exports are concerned.

Imports, on the other hand, showed a substantial increase in tonnage during October, the total of 1241 tons being well above that of any other month this year, while the value of imports for the month also reached a new high level for 1929 of £205,326. It is significant, too, to note that three times during the last five months for which returns are available, has the value of imports exceeded that of exports, while during the remaining two months exports came first by only a narrow margin.

With regard to ton values, the figure for exports has remained fairly steady throughout the year, while the ton value of imports rose fairly rapidly during the earlier months, reaching a peak in June which was maintained substantially until August. The months of September and October, however, reveal a downward tendency.

The Electrical Industry Shows Rapid Growth

The British electrical industry has shown evidence of remarkable development of late, and during the first nine months of the present year a record was set up in regard to export trade. Exports amounted to £8,000,000 during this period, and home orders to not less than £16,000,000.

It is significant to note that practically every contract in connection with the reorganization of the electricity supply in Holland has come to this country, and that, despite high tariffs, exports to Europe are steadily increasing. There has also been a rapid increase in the size of electrical installations, and whereas a few years ago a unit of 15,000 horsepower was considered large, there is today a demand for units up to as much as 90,000 horsepower in a single set.

The Automobile Industry

The automobile industry at the moment is in a position of embarrassment owing to the uncertainty that prevails in regard to the financial policy of the Government. On the one hand, there is no certainty that the McKenna duty on imported cars will not be withdrawn, while on the other hand, it is rumored that the present horsepower tax may be repealed or modified. Now should the McKenna duties be withdrawn, the main protection of the home manufacturers against competition from abroad will lie in the smaller rated horsepower of the average British car engine, while on the other hand, should the horsepower tax be repealed, a small efficient engine will be of little value as a sales argument.

Any derangement of the McKenna duties in favor of free entry of foreign cars, as has been pointed out in London MACHINERY of December 17 by Sir Alfred Herbert, President of the Machine Tool Association, will have an adverse reaction, not only upon the automobile industry, but upon machine tool builders.

In the meantime, in the case of most firms the output is being slowly increased in preparation for the coming season. Manufacturers of commercial vehicles, almost without exception, are well employed. The demand for trucks is improving, and there is an exceptional amount of business in passenger vehicles.

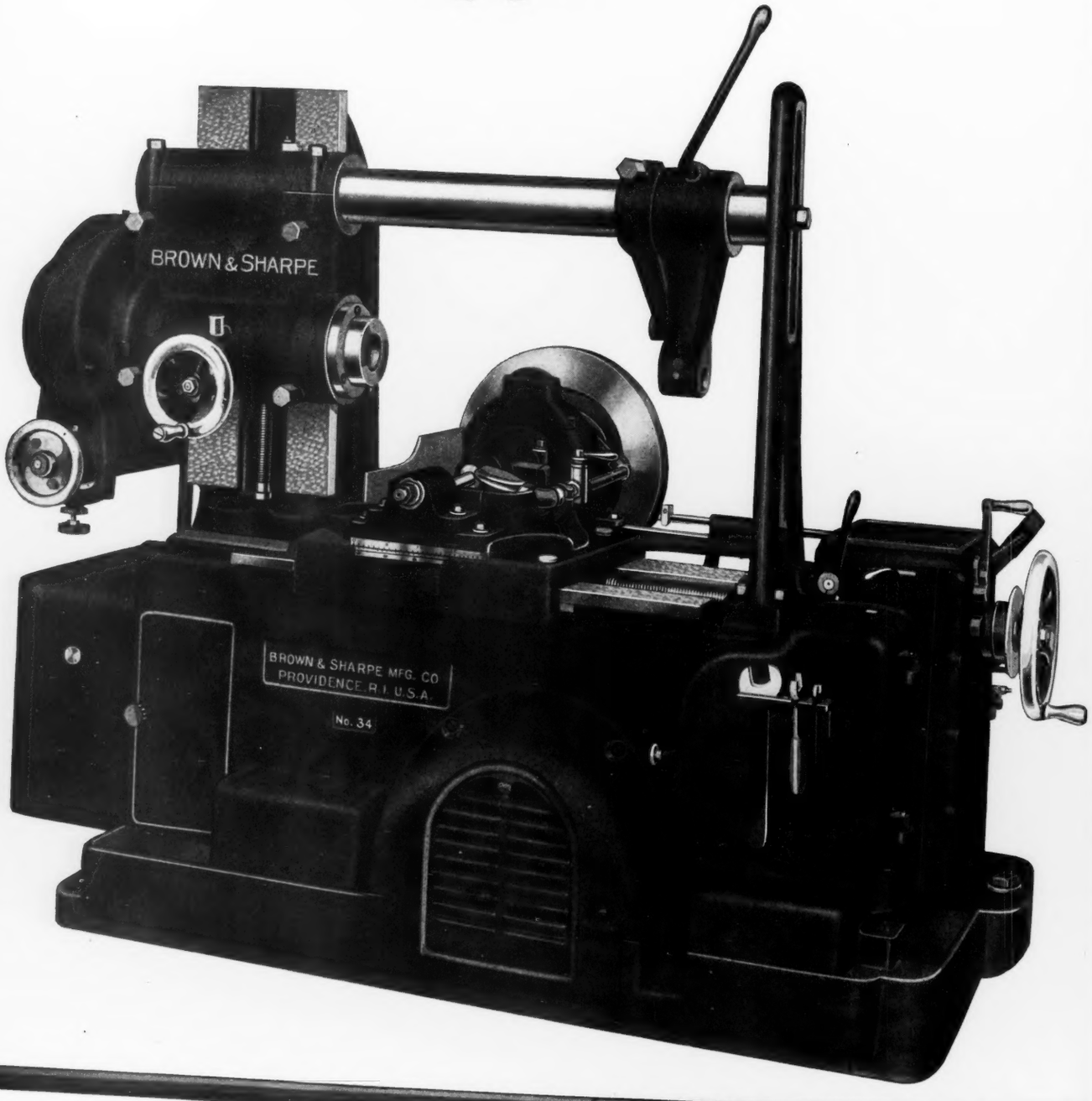
* * *

MEETING OF STEEL FOUNDERS' SOCIETY

The regular monthly meeting of the Steel Founders' Society of America held at the William Penn Hotel, Pittsburgh, Pa., December 12, revealed the rapid strides that are being made by the organization in placing the steel casting industry on a firmer basis. Seventy-five leading executives were present at the meeting. Announcement of the election of nine foundries to membership during the past month indicates the interest the industry takes in the society. Among the problems that have been dealt with since the reorganization of the society last October have been the application of accurate cost finding methods, the combating loose trade practices and customs, and a study of over-capacity and internal dissensions. As a first step in handling trade disputes, the society has formally endorsed and adopted the principles of the American Arbitration Association.

George Batty, technical director, Steel Casting Development Bureau, Philadelphia, delivered an interesting address on the subject of "Undeveloped Wealth in the Steel Foundry." Mr. Batty called attention to the fact that practical operators and foundry superintendents acquire a tremendous amount of data on foundry operation; but they do not have the time, opportunity, or training to deduce from their observations improved practices or remedies for adverse conditions. These empirical facts existing in the minds of the operators constitute unexploited wealth in our steel foundries, for if these observations were corollated by a scientific technician, new methods could be devised that would materially reduce present-day waste in both material and human energy. According to Mr. Batty, best results can be achieved when such a technical man can speak the same language as the operator, who is usually inclined to distrust anything that is unrelated to everyday practice.

NEW



FEATURES

BROWN & SHARPE No. 34 GEAR HOBBING MACHINE

1 Frictional power losses are reduced to a minimum through the extensive use of anti-friction bearings throughout the machine.

2 Simplified oiling — The indexing mechanism and the feed case bearings are constantly supplied with filtered oil, assuring correct lubrication of these important points.

3 The hob slide hand feed wheel cannot be engaged when the power fast advance or return is in use, thus eliminating the possibility of accident.

4 The cutter lubricant pump is located at the rear of the machine where adjustments can be easily made. The pump can be readily stopped when cutting lubricant is not required.

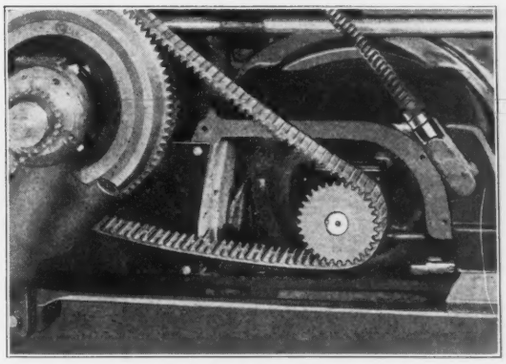
MOTOR-IN-BASE DESIGN

When motor driven, the No. 34 Gear Hobbing Machine forms an unusually compact unit. The motor is mounted on an adjustable plate and enclosed in a well ventilated compartment in the base.

Power is transmitted from the motor to the machine by silent chain and sprockets, a drive which is both positive and efficient.

The motor-in-base design provides protection to the motor as well as an unusual economy of floor area, no additional space being required for the electrical equipment.

Complete specifications will be mailed to you at your request.



BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

PERSONALS

S. C. VESSY, president of the W. W. Sly Mfg. Co., Cleveland, Ohio, has been elected a director of the American Foundrymen's Association to fill the vacancy caused by the death of H. Cole Estep.

FRANK A. SEEDLOCK, for many years superintendent of the Vixen Tool Co., Newark, N. J., is now associated in a similar capacity with Filecraft, Inc., of Cleveland, Ohio, manufacturer of "Tru-arc" and "Master" files.

HARRY R. NELSON, who has been connected with the Charles L. Anderson Machinery Co. of Chicago, Ill., for the last sixteen years, has now joined the Tool Equipment Sales Co., 18 S. Clinton St., Chicago, Ill., in the capacity of mechanical engineer.

E. O. SHREVE, manager of the industrial department of the General Electric Co., Schenectady, N. Y., has been appointed assistant vice-president on the staff of vice-president J. G. Barry. WILLIAM W. MILLER, assistant manager of the industrial department, will succeed Mr. Shreve as manager.

RAY M. HUDSON, for several years assistant director of the National Bureau of Standards, in charge of commercial standardization, left the Bureau at the beginning of the year to assume his new duties as secretary of the Massachusetts Division of the New England Council, with headquarters at Boston, Mass.

R. G. HOLMES, Detroit representative of Putnam machine tools, manufactured by Manning, Maxwell & Moore, Inc., with offices at the General Motors Building, has resigned. J. H. WELSH, of the same office, will carry on the representation of Putnam lines of automotive and general-purpose machine tools for the Detroit district.

C. E. PIOCH, formerly general master mechanic of the Chrysler Corporation, has joined the staff of the Seneca Falls Machine Co., Seneca Falls, N. Y., manufacturer of the Lo-swing lathe. Mr. Pioch, who has had wide experience in production methods, will be in charge of the further development of the Lo-swing method of turning.

ARTHUR W. F. GREEN has assumed the duties of manager of the tool steel division of the Edgcomb Steel Co., Philadelphia, Pa., handling the product of the Vanadium Alloys Steel Co. Mr. Green was formerly sales metallurgist with the Poldi Steel Corporation of America, and previous to that was metallurgist of the John Illingworth Steel Co. for more than twelve years.

J. J. HARTLEY has been appointed chief engineer of the Link-Belt Co.'s Pershing Road plant at Chicago, Ill. Mr. Hartley was formerly in charge of foundry equipment sales in the western division of the Link-Belt organization. He has been connected with the company for the last nineteen years. W. L. HARTLEY succeeds his brother as manager of the foundry equipment sales department.

CHARLES M. NUCKOLLS, formerly with the International Harvester Co., Tractor Works, Chicago, Ill., is now in charge of design and development work in the Crane Department of H. D. Conkey & Co., Mendota, Ill. Prior to his connection with the International Harvester Co., he was associated with the Whiting Corporation, Harvey, Ill., and the Shaw Crane Works, Muskegon, Mich.

GLENN MUFFLY, consulting engineer for Copeland Products, Inc., has been appointed to the executive staff of American Cirrus Engines, Inc., a unit of Allied Motor Industries, Inc., Marysville, Mich. Mr. Muffly was formerly sales manager of the Lees-Bradner Co., Cleveland, Ohio, and has had wide experience in the design and production of aircraft engines. He will continue to serve as consulting engineer for Copeland Products, Inc.

WILLIAM E. KERRISH, for the last three and one half years in charge of advertising and general publicity for the Boston Gear Works Sales Co. of Norfolk Downs, Mass., has resigned that position to become advertising and sales promotion manager for the Norfolk Paint & Varnish Co. and the Norfolk Stores, Inc., of that city. Mr. Kerrish was formerly publicity lecturer for Wadsworth Howland & Co., Inc., Boston, manufacturers of industrial paints and finishes.

E. B. NICHOLS has been appointed chief engineer of the Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. He was at one time chief engineer of the Pfaudler Co., Rochester, N. Y., and later held the same position with the Victor Talking Machine Co., Camden, N. J. Just prior to his connection with the Brown Instrument Co., he was associated with the Bell Telephone Laboratories. Mr. Nichols will act in an administrative capacity, supervising the work of the engineering staff.

CHARLES E. MITCHELL has been appointed associate manager of the Gray Iron Institute, Terminal Tower Building, Cleveland, Ohio. Mr. Mitchell will assist Arthur J. Tuscany, manager of the Institute, in the executive work of the association. Mr. Mitchell, who for ten years was an accountant and office manager with the Bell Telephone Co., Cleveland, Ohio, and later has been engaged as salesman, sales organizer, and sales director, is well qualified for the major duties before him, which will deal with accounting methods, merchandising, and association promotion work.

A NEW LACQUER FOR FINISHING MACHINERY AND MACHINE PARTS

A new lacquer, known as "Glyptal," has been developed in the General Electric Co.'s research laboratories and is now being commercially manufactured. The material makes a suitable base for finishing and protecting materials, such as paints, varnishes, and lacquers. It is stated in the *General Electric Review* that "Glyptal" lacquers are resistant to all mineral oils, and, when baked, to gasoline, kerosene, etc. They also resist weak acids and alkalies. They withstand temperatures in excess of 600 degrees F.

These lacquers are suitable as finishing coatings for any surface; and are particularly valuable for covering surfaces that are ordinarily difficult to coat, such as aluminum and galvanized iron, because tenacious adhesion is one of their outstanding properties. The finish which they produce is smooth, easily cleaned, and durable, because it is unusually resistant to abrasion. Up to the present time they have been produced in the following colors: aluminum, blue, brown, green, gray, black, and red.

All the Glyptal lacquers have basically the same general characteristics and may be applied by spraying, brushing, or dipping. They dry in the air, dust-free, in 30 minutes, may be handled in 2 hours, and set hard in 8 to 10 hours. The drying time is greatly accelerated by heat. Baking improves the coatings and somewhat prolongs their good qualities where this treatment is convenient.

Because of the many uses for Glyptal lacquers, it would be impractical to give more than a few specific examples, but the following will at least indicate the wide scope of their possible application:

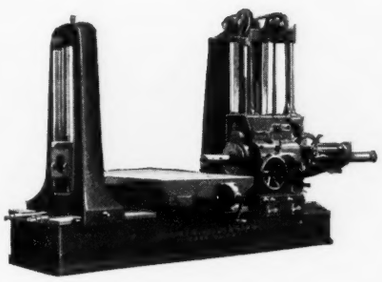
The aluminum Glyptal lacquer is particularly resistant to heat. In fact, tests show that temperatures as high as 600 degrees F. produce practically no discoloration in the finish, for which reason it will prove unusually serviceable as a coating for metal parts that are exposed to high temperatures (as furnace stacks, electric furnace parts, radiators, gasoline engine parts, steam boilers, etc.). It nevertheless possesses all the good qualities of the other Glyptal lacquers for uses at ordinary temperatures, and in addition has better light-reflecting characteristics which make it doubly valuable in poorly illuminated surroundings.

The blue, brown, green, gray, and black Glyptal lacquers are intended primarily for finishing purposes. As coatings for manufactured articles, especially those of metal, experience has shown that they afford worthwhile economies. Where fine finishes are desired on rough surfaces, and it has been the practice to prime, fill, sand, size, and paint the surfaces, the substitution of any of these Glyptal lacquers for the paint makes the operations of priming and sizing unnecessary.

* * *

The electrification of railways in 1929 proceeded at an unprecedented rate, and new records were achieved in the number of electric and oil-electric locomotives built. The gasoline-electric type of railway car was provided with increased power, and found application on an increasing number of railroads for local passenger traffic.

OHIO Horizontal Boring Drilling & Milling Machines



OHIO Horizontal Boring, Drilling and Milling Machines have, in the past, been built for Joseph T. Ryerson & Son, Inc., by the Ohio Machine Tool Company. The complete manufacturing responsibility has now been assumed by the Ohio Machine Tool Company through its outright purchase of the line. However, Joseph T. Ryerson & Son, Inc., retain sole right of distribution. In this way the combined facilities and resources of the two organizations are available for the production and distribution of these machines.

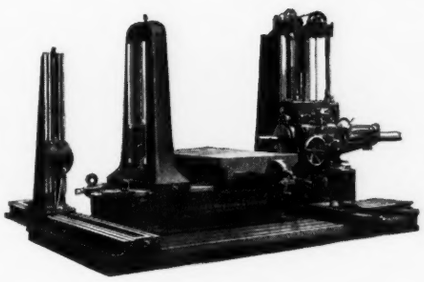
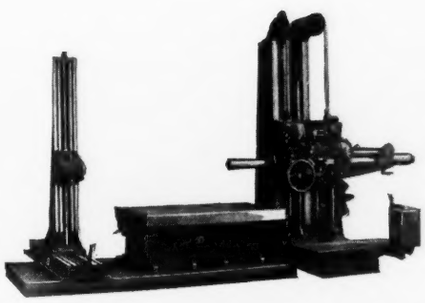


TABLE TYPE MACHINES

Built with 4″ and 5″ spindle diameters with dimensions, specifications and complete line of attachments to meet the requirements of the modern shop.

COMBINATION FLOOR AND TABLE TYPE MACHINES

Built with 4″ and 5″ spindle diameters consisting of standard floor type machine, equipped with table type bed, saddle, bar support either hand or power operated, giving practically all the advantages of the table type machine and with the table unit removed the great range of the floor type machine is made available.



FLOOR TYPE MACHINES

Built with 4″ and 5″ spindle diameters, with vertical traverse of spindle up to 7′ 0″ and horizontal traverse of post on runway to suit the job. Bed plates, bar supports, and other accessories to suit requirements. Universal tilting and revolving tables, plain rotary, power operated rotary and stationary work tables.

PLANER TABLE TYPE MACHINES

Built with 4″ and 5″ spindle diameters, with tables, beds and dimensions arranged to suit the job.

OHIO MACHINE TOOL COMPANY, Kenton, Ohio

Sole Distributors

JOSEPH T. RYERSON & SON INC.

CHICAGO MILWAUKEE MINNEAPOLIS DULUTH DENVER LOS ANGELES SAN FRANCISCO ROCKFORD
HOUSTON KANSAS CITY TULSA ST. LOUIS CINCINNATI CLEVELAND DETROIT BUFFALO
PITTSBURGH PHILADELPHIA RICHMOND BOSTON JERSEY CITY NEW YORK DALLAS GRAND RAPIDS

OBITUARIES

DAVID C. KLAUSMEYER, general manager of the Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio, died December 6. Mr. Klausmeyer was born in New York City October 31, 1881. He was educated in the Cincinnati Public and High Schools and subsequently graduated from the mechanical department of the Ohio Mechanics Institute. Later he continued his studies at the University of Cincinnati. He started work in the shop of

the Bickford Drill & Tool Co. as an apprentice, afterward working in the drafting-room. In the course of time he was placed in charge of the drafting-room and of the designing of drilling machinery, on which he became a well-known authority. During recent years he has been general manager of the Cincinnati Bickford Tool Co. Mr. Klausmeyer was an active member of the American Society of Mechanical Engineers and of the Engineers' Club of Cincinnati. In the passing away of Mr. Klausmeyer, the machine tool industry has lost a most able man, and he will be missed by a host of friends all over the world.

MAURICE A. OUDIN, vice-president of the International General Electric Co., died at his home in Schenectady, N. Y., on December 4 of pneumonia, at the age of sixty-three years. Mr. Oudin was a graduate of the College of the City of New York and of Princeton University. In 1891 he joined the Thomson-Houston Electric Co. of Lynn, Mass., and has since served in various capacities with its successor, the General Electric Co. at Schenectady. He was active in the power and mining interests. In 1919 when the International General Electric Co. was formed to take over all the activities of the parent company relative to foreign business, Mr. Oudin was appointed its first vice-president.

FRANK A. HUNTER, president of the Hunter Saw & Machine Co., 5662 Butler St., Pittsburgh, Pa., died at his home in that city on November 19, aged fifty-seven years. Mr. Hunter, together with his brother, Harry S. Hunter, organized the Hunter Saw & Machine Co. in 1898. He served as secretary and treasurer of the company until 1925, when, at the death of his brother, he became president. He had been active in business up until the last two years, at which time illness confined him to his home.

GEORGE W. SEVERSON, general manager of the Bowen Products Corporation, Auburn, N. Y., died December 6 at the Packer Hospital in Sayre, Pa., after an operation. Mr. Severson had been connected with George W. Bowen and the Bowen Products Corporation since 1896, and aided greatly in building up the business. He was well known in the machinery industry, especially by the manufacturers of bicycles and the earlier builders of automobiles.

PRESCOTT I. JOHNSTON, for many years shop superintendent of the Consolidated Machine Tool Corporation of America, died in Rochester, N. Y., December 14.

J. H. HOLLINGER, Philadelphia representative of the Landis Tool Co., Waynesboro, Pa., died on November 18.

TRADE NOTES

REED-PRENTICE CORPORATION, Worcester, Mass., has moved its New York sales office to 41 Broad St., New York City.

LINDE AIR PRODUCTS CO. has opened a new oxygen plant at 60 Knott St., Portland, Ore. A. D. Davis is superintendent of the Portland plant.

UNION CHAIN & MFG. CO., Sandusky, Ohio, has opened a new district office at 812 Marshall Bldg., Cleveland, Ohio. F. H. Dalrymple will be in charge as district representative.

AMERICAN ELECTRIC FUSION CORPORATION, Chicago, Ill., has appointed the R. D. Thomas Co. of Philadelphia, Pa., agent for AEF spot, seam, and tube welders in Philadelphia and the surrounding territory.

FEDERAL PRESS CO., Elkhart, Ind., manufacturer of open-back inclinable punch presses has appointed the H. A. Smith Machinery Co. exclusive representative for the company in the Syracuse, N. Y., territory.

STERLING DIE CASTING CO., INC., 749 Thirty-Ninth St., Brooklyn, N. Y., is planning an extension to its plant in the form of an additional one-story building, 25 by 70 feet, which will be used for the new die-casting department.

MCCROSKY REAMER & TOOL CORPORATION, Meadville, Pa., has just completed a 25 per cent addition to its plant in order to accommodate increased machine tool and heat-treating equipment as part of a general plan of expansion.

AMERICAN FLUID MOTORS CO., Philadelphia, Pa., has appointed the Reeves & Skinner Machinery Co., St. Louis, Mo., representative of the company, handling the sale of Hele-Shaw pumps in Missouri and the southern half of Illinois.

ELECTRIC SPECIALTY CO., Stamford, Conn., manufacturer of motors, generators, dynamotors, etc., is increasing its manufacturing capacity approximately 40 per cent by the erection of a two-story steel and brick addition to its plant.

LAMSON & SESSIONS CO. and the LAKE ERIE BOLT & NUT CO. announce a merger of the two companies. George S. Case is president of the combined company, and N. J. Clarke, formerly president of the Lake Erie Bolt & Nut Co., is vice-president.

HEVI DUTY ELECTRIC CO. has moved into new and larger quarters at 4100 Highland Blvd., Milwaukee, Wis. The new building will provide double the present productive capacity, and is especially equipped for building furnaces and furnace equipment.

PINES WINTERFRONT CO. has just completed a new plant at Cicero Ave. and Division St., Chicago, Ill., which is expected to increase the production considerably. The new plant provides approximately 200,000 square feet of space on two floors.

LEWIS-SHEPARD CO., Watertown Station, Boston, Mass., has appointed the Lincoln Products Corporation, 31 Fulton St., Newark, N. J., distributor in northern New Jersey for the jacklifts, arc-welded platforms, and stackers made by this company.

KINITE CORPORATION, Milwaukee, Wis., has appointed the Danly Machine Specialties Corporation, 2112 S. 52nd Ave., Chicago, Ill., selling representative of the company for the Chicago district, including Illinois, Missouri, upper Indiana, and Iowa.

STANLEY ELECTRIC TOOL CO., a subsidiary of the Stanley Works, New Britain, Conn., will manufacture and distribute, in the future, the electrically operated hand tools developed by the Stanley Rule and Level Co., including electric drills, screwdrivers, bench and aerial grinders, etc.

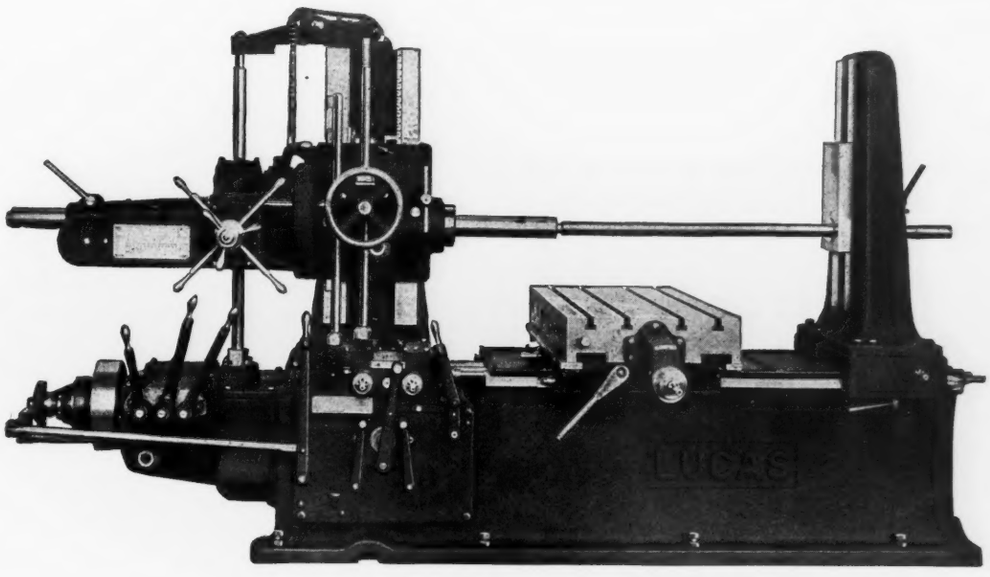
OSTER MFG CO., Cleveland, Ohio, and the WILLIAMS TOOL CORPORATION, Erie, Pa., have effected a merger of the two companies. This brings together two representative lines of pipe machinery. R. B. Tewksbury, president of the Oster Mfg. Co., will become president of the new company.

CENTURY ELECTRIC CO., 1806 Pine St. St. Louis, Mo., announces that all communications and orders from the New York City territory for this company and for ROTH BROS. & CO., Chicago, Ill., should now be addressed to the Century Electric Co., Room 1480, 50 Church St., New York City.

NATIONAL TOOL CO., Madison Ave. at W. 112th St., Cleveland, Ohio, announces that the United States District Court for the Northern District of Ohio has decided in favor of the National Tool Co. the suit filed by the Lees-Bradner Co. in connection with alleged infringement of patents Nos. 1,390,145 and 1,462,985.

U. S. ELECTRICAL MFG. CO., is completing the construction of a large addition to its plant in Los Angeles which will

The cost of repairs is part of the cost of production



The "PRECISION"

Boring, Drilling and MILLING MACHINE

WE ALSO MAKE THE

LUCAS POWER

Forcing Press

in your repair shop does the work of several single purpose machines, always as well, usually better, invariably for less investment and therefore more economically.

The cost of repairs on the PRECISION itself is negligible.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

approximately double the present capacity. The new structure will be 140 by 150 feet in size, with a wing 34 by 40 feet, and will give the plant a total floor area of more than 100,000 square feet.

GENERAL MFG. CO., Detroit, Mich., manufacturer of General flexible power presses, has appointed John M. Davie representative of the company in western Pennsylvania and northern Ohio, with the exception of Toledo and suburbs. Mr. Davie's headquarters will be at 2453 Overlook Road, Cleveland Heights, Ohio.

GEOMETRIC TOOL CO., New Haven, Conn., announces that the sale and servicing of Geometric self-opening dieheads, collapsing taps, and threading machines in eastern Missouri, southern Illinois, and the states of Arkansas and Oklahoma is now being handled by R. T. Monahan, 1525-1529 Arcade Building, 812 Oliver St., St. Louis, Mo.

LINCOLN ELECTRIC CO., Coit Road and Kirby Ave., Cleveland, Ohio, manufacturer of Stable-Arc welders and Linc-Weld motors, has appointed R. B. Tuhey district representative at Indianapolis, Ind., with offices at 517 Peoples Bank Bldg. S. H. Taylor has been made district representative at Los Angeles, Cal., with headquarters at 812 Mateo St.

DETROIT ALLOY STEEL CO., Detroit, Mich., has opened an eastern district office for the distribution of PRK-33 patented cobaltcrom air-hardening tool-steel castings under the sole manufacturing rights secured from Darwin & Milner, Inc., Cleveland, Ohio, American Division of Darwin's Ltd. William C. Eakin has been appointed eastern district manager, with offices at 707 Berkshire Ave., Pittsburgh, Pa.

TRACKSON CO., 500 Clinton St., Milwaukee, Wis., manufacturer of full-crawlers and tractor equipment, has announced plans for the erection of a new factory early in the spring. The new plant will be a large one-story building equipped to provide every facility for efficient production. When the building is completed, the several plants that the company now operates in Milwaukee will be consolidated under one roof.

THE MECHANICAL IMPROVEMENTS CORPORATION, 905 Division St., Camden, N. J., has been organized to develop ideas of a mechanical nature and obtain patents on them, to purchase patents and develop patented articles, and to render engineering, drafting, and model construction service. The officers are E. R. Fennimore Johnson, president; A. C. Dyer, secretary and treasurer; and H. C. Hollerith, Jr., plant manager.

LINN TRAILER CORPORATION, 433 Chestnut St., Oneonta, N. Y., has been incorporated to manufacture light trailers ranging from a single-wheel trailer of 800 pounds capacity for use back of automobiles to the heavy type of crawler or track laying trailers of 10 to 15 tons capacity which are towed by big tractors. The officers of the company are: President, H. H. Linn; vice-president, E. W. Wheeler; treasurer, C. J. Smith; and secretary, H. W. Naylor.

WILLIAM K. STAMETS announces that the Cleveland office of the company is now located at 462-464 Rockefeller Building, where larger quarters have been secured, about one-third additional floor space being available. George D. Miller is the Cleveland district manager. Announcement is also made that William K. Stamets has been appointed sales representative in the northern Ohio territory for Andrew C. Campbell, Inc., manufacturer of mechanical nibblers.

UNIVERSAL BEARING METALS CORPORATION, 258 State St., Rochester, N. Y., has bought all the assets, processes, patents, copyrights, patterns, good-will, etc., of BEARIUM BEARINGS, INC., and will continue to supply Bearium bronze and Bearium alloys. The operating and sales force of Bearium Bearings, Inc., will be kept intact, and no changes are contemplated in the product nor in the sales policies. The president and treasurer of the company is E. P. Langworthy, and the vice-president and secretary is H. M. Rees.

HILL EQUIPMENT ENGINEERING CO., 4620 Delmar Blvd., St. Louis, Mo., has been organized by Lockwood Hill, who for the last ten years has been a member of the Blackman Hill Co. of St. Louis. The new organization will have the exclusive sale of the products of the Lincoln Electric Co. and the Baker Industrial Truck Co. in the St. Louis metropolitan district and the eastern Missouri and southern Illinois territories. The new company will carry a complete stock of Linc-Weld motors and Stable-Arc welders, welding supplies, accessories, and parts.

HARRY W. LEIGHTON CO., 565 W. Washington St., Chicago, Ill., has been organized to continue the business established by Harry W. Leighton fifteen years ago. Mr. Leighton has been a manufacturers' representative in the Chicago territory in the railway and industrial tool and supply fields representing the states of Illinois, Indiana, Michigan, Wisconsin, and Iowa for the Cleveland Steel Tool Co., Cleveland, Ohio; Buckeye Portable Tool Co., Dayton Pneumatic Tool Co., and Precision Gage & Tool Co., all of Dayton, Ohio; and the Schauer Machine Co. of Cincinnati, Ohio. Mr. Leighton will be president and treasurer of the new company, and William E. Thurber, vice-president and secretary. For a number of years, Mr. Thurber has been manufacturers' representative in the Chicago territory for the Colonial Tool Steel Co.

OAKITE PRODUCTS, INC., 22 Thames St., New York City, held its annual sales conference November 20 to 23 in New York City, which was attended by 110 district managers and representatives from all parts of the United States and Canada. Papers were read by different members of the organization on paint removing, cleaning steel for porcelain enameling, servicing automobiles and buses, cleaning service for railroads, as well as on many other subjects applying to industries in which cleaning problems are of importance. Laboratory demonstrations were made by the technical and laboratory staff of the home office, as well as by those field men who have made certain applications their special study. Each year the company brings together its field organization in order to exchange information and acquaint every man with the improvements that have been made in cleaning equipment and methods.

COMING EVENTS

JANUARY 20-24—Annual meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

FEBRUARY 7-8—Semi-annual meeting of the American Society for Steel Treating in New York City; headquarters, Hotel Pennsylvania. Secretary, W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

FEBRUARY 18-20—Aeronautic Meeting of the Society of Automotive Engineers at St. Louis, Mo. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

MARCH 3-5—National Management Congress, sponsored by the American Society of Mechanical Engineers, to be held at the Hotel Stevens, Chicago, Ill. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MARCH 5-7—National Materials Handling Meeting, sponsored by the American Society of Mechanical Engineers, to be held at the Hotel Stevens, Chicago, Ill. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

APRIL 5-9—Fiftieth Anniversary Celebration of the American Society of Mechanical Engineers in New York and Washington, D. C. For further information address Calvin W. Rice, secretary, 29 W. 39th St., New York City.

APRIL 7-12—Annual convention and exposition of the American Oil Burner Association at the Hotel Stevens, Chicago, Ill. Executive secretary, Harry F. Tapp, 342 Madison Ave., New York City.

APRIL 8-9—Aeronautic Meeting of the Society of Automotive Engineers at Detroit, Mich. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

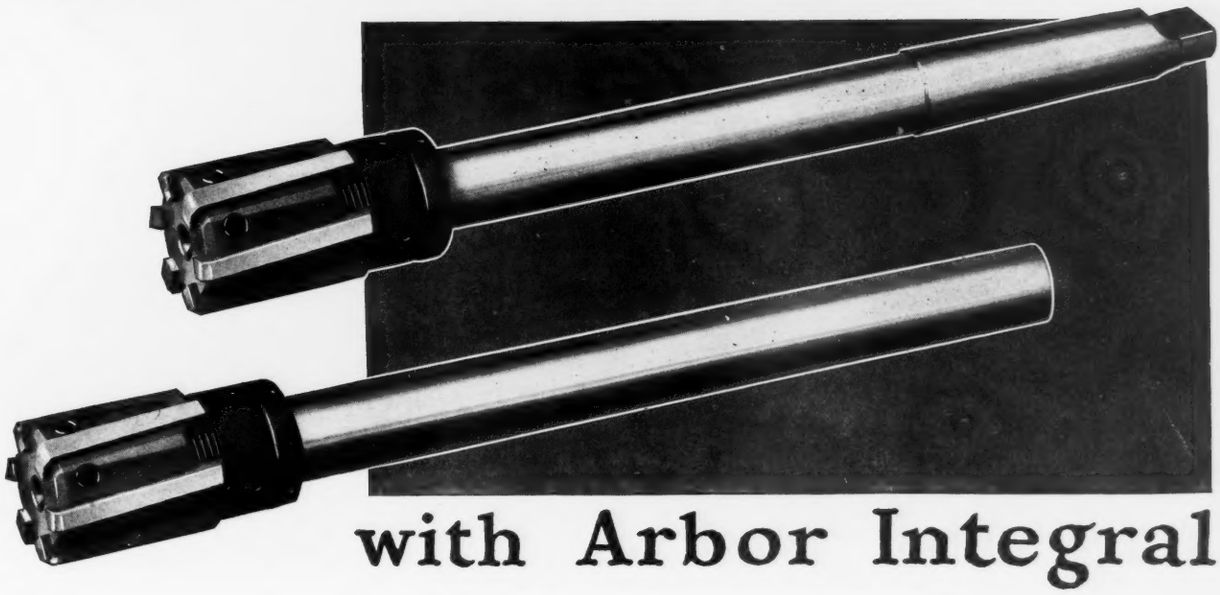
MAY 12-16—Convention and exhibition of the American Foundrymen's Association to be held in the Public Auditorium, Cleveland, Ohio. C. E. Hoyt, manager of exhibits, 222 W. Adams St., Chicago, Ill.

MAY 19-21—Fifth National Aeronautic Meeting, sponsored by the American Society of Mechanical Engineers, to be held at Dayton, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 21-23—National Foreign Trade Convention at Los Angeles, Cal. Secretary, O. K. Davis, National Foreign Trade Council, India House, New York City.

JUNE 9-12—Semi-annual meeting of the American Society of Mechanical Engineers at Hotel Book-Cadillac, Detroit, Mich. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

HEAVY-DUTY



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For heavy-duty jobs—where unusual strength and ruggedness are needed, and *speed*, too—use the Wetmore Adjustable Heavy-duty Reamer (Type No. 11) with arbor integral.

This is a six-blade reamer, ranging in size from 1″ to 2-15/16″ inclusive. Larger sizes made special to order. Wide range of adjustment provides for wear and regrinding, so that this reamer with its original blades actually outlasts several solid, non-adjustable reamers. The 1/8″ projection of the blades over the end of the reamer body allows the chips to fall off ahead of the reamer, so they do not clog up along cutting edge of blades.

Here are four features that make these Wetmore Heavy-duty Reamers, as well as other types of Wetmore reamers, first choice in so many plants:

1 Adjustment to the thousandth of an inch can be made in less than a minute. In fact, the Wetmore is the quickest and easiest adjusting reamer made.

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3 Left Hand Angle Cutting Blades that prevent digging in, chattering and scoring while backing out. Shearing effect of blades increases life of cutting edge.

4 No grinding arbor required for regrinding. Wetmore Reamers can be reground on their original centers.

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"THE BETTER REAMER"

AUGUST 24-29—Third International Congress of Applied Mechanics to be held at the Royal Technical Institute, Stockholm, Sweden. Further information may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SEPTEMBER 22-26—Annual convention and exposition of the American Society for Steel Treating in Chicago, Ill. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

DECEMBER 1-6—Ninth National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

DECEMBER 1-6—Fifty-first annual meeting of the American Society of Mechanical Engineers in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

CALENDARS RECEIVED

UNION SWITCH & SIGNAL CO., Swissvale, Pa., manufacturer of drop-forgings, is distributing a calendar for 1930, showing three months on each sheet.

CARNEGIE STEEL CO., Pittsburgh, Pa. Annual Safety Calendar for 1930, containing reproductions of posters submitted by school children in the Annual Safety Poster Contest, organized by the company.

NEW BOOKS AND PAMPHLETS

TOPICS FOR SAFETY MEETINGS. 14 pages, 8 1/2 by 11 inches. Published by the National Safety Council, 108 E. Ohio St., Chicago, Ill., as Safe Practices Pamphlet No. 93.

INDUSTRIAL SAFETY ORGANIZATION. 7 pages, 8 1/2 by 11 inches. Published by the National Safety Council, 108 E. Ohio St., Chicago, Ill., as Safe Practices Pamphlet No. 42.

INDEX TO A.S.T.M. STANDARDS AND TENTATIVE STANDARDS. 133 pages. 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa.

WELDING AND CUTTING NOMENCLATURE, DEFINITIONS, AND SYMBOLS. 48 pages, 6 by 9 inches. Published by the American Welding Society, 33 West 39th St., New York City. Price, 50 cents.

WELDED CHAIN. 12 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Simplified Practice Recommendation No. 29 of the Bureau of Standards.

SAFETY IN STRUCTURAL AND SHEET METAL FABRICATION. 12 pages, 8 1/2 by 11 inches. Published by the National Safety Council, 108 E. Ohio St., Chicago, Ill., as pamphlet No. ME-3 of the Industrial Safety Series.

THE PLASTER-MODEL METHOD OF DETERMINING STRESSES APPLIED TO CURVED BEAMS. By Fred B. Seely and Richard V. James. 36 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 195 of the Engineering Experiment Station. Price, 20 cents.

ANNUAL REPORT OF DIRECTOR OF THE BUREAU OF STANDARDS FOR THE YEAR ENDED JUNE 30, 1929. 51 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 102 of the Bureau of Standards.

MATERIAL CONTROL AND STORESKEEPING IN MACHINE SHOPS AND FOUNDRIES. By Willis Wissler. 284 pages, 8 1/4 by 11 inches. Published by the Ohio State University Press, Columbus, Ohio.

This pamphlet contains a series of studies of Ohio manufacturing concerns selected with respect to routines in effect in handling materials in process of manufacture.

AMERICAN NATIONAL SCREW THREAD TABLES FOR SHOP USE—Two Sections. Section 1, dealing with standard threads, 15 pages, 9 by 11 1/2 inches. Section 2, dealing with special threads, 20 pages, 9 by 11 1/2 inches. Published by the United States Department of Commerce, Washington, D. C., as Miscellaneous Publications Nos. 98 and 99 of the Bureau of Standards.

THOMAS DAVENPORT, PIONEER INVENTOR. By Walter Rice Davenport. 165 pages, 6 by 9 inches. Published by the Vermont Historical Society, Montpelier, Vt. Price, $2.

As presented in this book, the story of the invention of the electric motor becomes an interesting addition to the history of engineering. Thomas Davenport, as a pioneer inventor, struggled valiantly to obtain recognition and cooperation, but such an epoch-making invention as his was not readily understood in the early days. Nevertheless, he had the necessary persistence to carry on, in spite of ridicule and obstacles. Like many others, Thomas Davenport, who was a blacksmith of Brandon, Vt., was far in advance of his time, and his vision of the future of the electric motor was but little less than prophetic. In commenting upon his work, Ex-Governor James Hartness, himself a prominent engineer, inventor, and manufacturer, says, "Few, if any, have equalled him in reaching out into new and unknown fields of endeavor." The history of Thomas Davenport's early life and of his patient work in attempting to develop the electric motor against the great odds of conservatism and scepticism makes interesting reading.

CONDITIONAL SALES. By Roger Sherman Hoar. 521 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $10.

In view of the widespread use of the installment method of selling, this book should be of considerable interest. It deals with one of the most popular methods of selling goods on the installment plan—the conditional sales contract, whereby the seller retains title to the goods until the price is paid and other stipulated conditions are fulfilled. This book is written for the use both of the business man and the lawyer. The author is commercial attorney for a company doing an installment business of many million dollars a year. He shows just what should be done to protect the seller's interest at every stage of the contract and in every section of the United States. The law is clearly explained, state by state, and the troubles likely to be encountered in drawing up the contract, filing, recording, renewing, foreclosing, and selling by auction are pointed out. The dangers incurred through liens of third parties are also discussed. The appendix contains a list of references to the statutes in question of the various states and a table of cases, as well as sixty-four convenient forms for use in the conditional sales business.

MACHINE DESIGN. By P. H. Hyland and J. B. Kommers. 448 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price, $4.

This book has been written to serve as a text-book from which to teach the elements of machine design. It is not intended to be a reference book that presents many applications of the same general idea. For each general problem discussed, a few applications have been analyzed to give a clear idea of the fundamental principles and enable the student to apply them to a special problem without difficulty. The aim has been to arrange the material for the convenience of both the student and the instructor. The text is divided into seventeen chapter heads treating of the following subjects: General considerations and procedure affecting design; metal-working and shop processes; pipes and pipe fittings; linkwork, instant centers, and velocity diagrams; cams; materials of construction; fundamental mechanics; riveted joints and fastenings; screw fastenings and power screws; keys; shafting and shaft couplings; toothed gears; friction and lubrication; friction as a useful agent; design of various machine elements; machine frames and safety engineering design. An appendix contains tabular matter of use to the designer.

NEW CATALOGUES AND CIRCULARS

STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. Bulletin entitled, "How Lebanon Adds a New Chapter to the Story of Steel Castings."

KINITE STEEL ALLOY. Kinite Corporation, Park Place, Milwaukee, Wis. Circular illustrating examples of Kinite dies and tools, and stampings produced with them.

AIR COMPRESSORS. Ingersoll-Rand Co., 11 Broadway, New York City. Bulletin illustrating and describing Ingersoll-Rand Type 30 two-stage air-cooled ball-bearing compressors.

TUNGSTEN-CARBIDE TOOLS. Advance Diamond Tool Co., 427 W. Congress St., Detroit, Mich. Circular illustrating tungsten-carbide tools with "Bulldog" type mountings.

INSULATING MATERIALS. General Electric Co., Merchandise Department, Bridgeport, Conn. Bulletin 309, announcing the new non-corrosive G-E Fiberduct for underfloor wiring.

LATHES. South Bend Lathe Works, 769 E. Madison St., South Bend, Ind. Catalogue printed in Spanish containing complete description of the construction and operation of South Bend lathes.

ELECTRIC HOISTS. Robbins & Myers, Inc., Springfield, Ohio. Bulletin 5031 containing clearance dimensions and diagrams, as well as price lists, of the various models of R & M electric hoists.

LIGHTING EQUIPMENT. Edison Lamp Works of General Electric Co., Harrison, N. J. Bulletin LD-159, containing data on floodlighting equipment. Bulletin LD-158, dealing with aviation lighting.

CONVEYOR FURNACES. General Electric Co., Schenectady, N. Y. Bulletin GEA-1174A, illustrating and describing the G-E mesh-belt conveyor furnace for the quantity heat-treatment of small parts.

AIRCRAFT EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-1182 and 1187, describing, respectively, electric gasoline gage for aircraft, and engine-temperature indicator for aircraft.

POLISHING AND BUFFING LATHES. Hammond Machinery Builders, 1604 Douglas Ave., Kalamazoo, Mich. Bulletin 10, covering the line of Rite-Speed polishing and buffing lathes made by this company.

GRINDING MACHINES. Oesterlein Machine Co., Cincinnati, Ohio. Booklet entitled "Precision Features of Oesterlein Grinders," illustrating and describing the outstanding features of Oesterlein grinders in progressive steps.

AUTOMATIC HOPPERS FOR CENTERLESS GRINDERS. Cincinnati Grinders, Inc., Cincinnati, Ohio. Bulletin illustrating the advantages of automatic hoppers as applied to a battery of Cincinnati centerless grinding machines.

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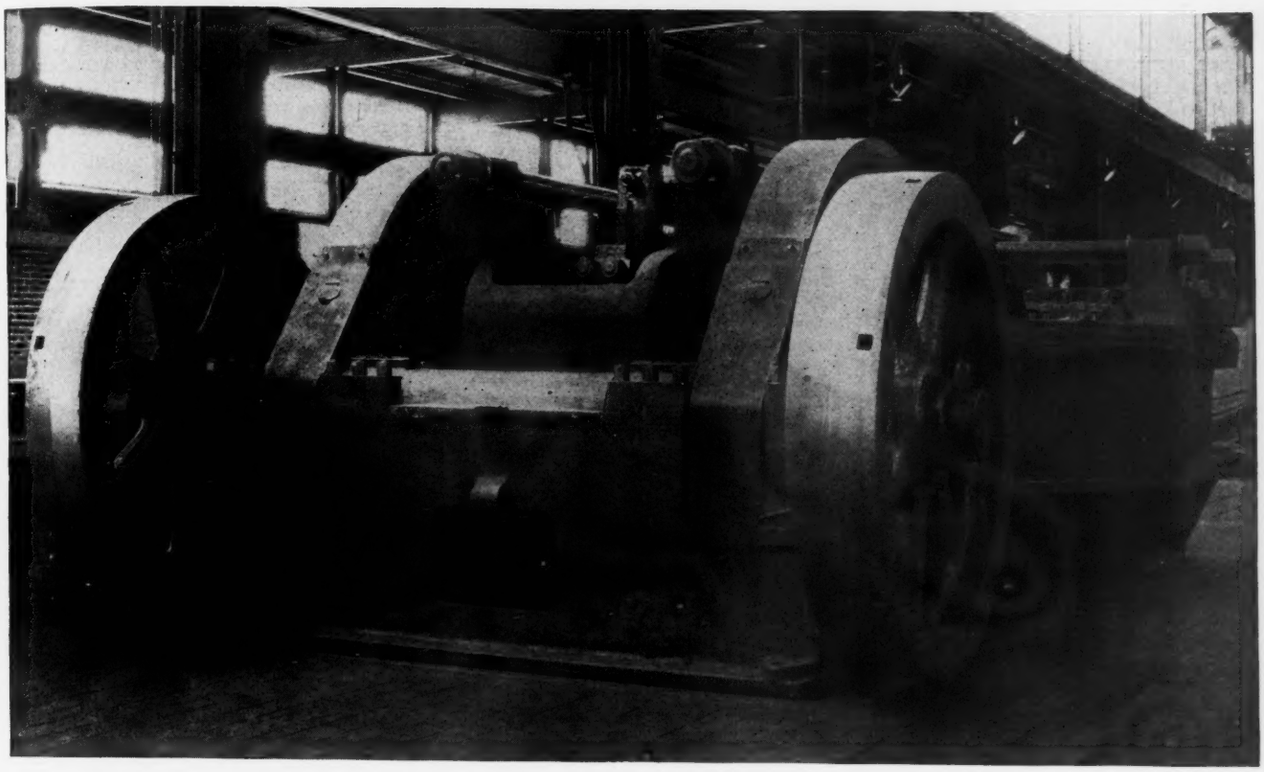

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ELECTRIC EQUIPMENT. Bishop Wire & Cable Corporation, 420 Lexington Ave., New York City. Circular descriptive of Bishop contact cable designed to take the place of electric switches for remote machine control and in many other installations.

WELDING MACHINES. Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio. Specification sheets covering the various types of Lincoln Stable-Arc 300-ampere welders, which are made in six different models for both stationary and portable use.

FLEXIBLE COUPLINGS. Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. Booklet on the use and construction of the Diamond-Clark flexible coupling. Photographs of applications and data on sizes and selection of couplings are included.

TOOLPOST GRINDERS. R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill. Catalogue illustrating and describing in detail the Haskins HL-5 flexible-shaft toolpost grinder. Illustrations showing the grinder in use on screw machines, lathes, and shapers are included.

AUTOMATICS. National Acme Co., Cleveland, Ohio. Circular illustrating Gridley four-spindle automatics, four-spindle chucking automatics, and five-spindle automatics as well as examples of Namco opening threading dies, collapsing taps, and the "Positive" industrial centrifuge.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Revised pages for New Departure engineering handbook, giving data for single- and double-row ball bearings. Bulletin No. 191 FE, illustrating the application of ball bearings in a heavy-duty spindle with manual adjustment for preloads.

ARC-WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Set of bulletins entitled "Studies in Structural Arc Welding," showing various buildings in the construction of which the arc-welding process has been used. Different details in the construction that have been arc-welded are illustrated by line drawings.

CHAIN HOISTS. Ford Chain Block Co., Philadelphia, Pa. Catalogue giving descriptive data and prices on the line of chain hoists made by this concern. The special advantages of each type are thoroughly explained, and many useful tables of hoisting data are included. A large number of illustrations show various applications of Ford hoists.

FLAT TURRET AND AUTOMATIC LATHES. Jones & Lamson Machine Co., Springfield, Vt. Catalogue illustrating and describing in detail the Jones and Lamson 2 1/2-by 24-inch turret lathe, and 12-inch chucking lathe. Catalogue descriptive of the 24-inch Fay automatic lathe, which is now made in three swings of 12, 14, and 24 inches.

DIAMOND BORING EQUIPMENT. Automatic Machine Co., Bridgeport, Conn. Coulter Engineering Data Bulletin No. 101, covering information on diamond tool boring, showing a photograph and line engraving of the fixture used for holding the work—a connecting-rod—and giving detailed information about the operation of boring with a diamond tool.

MATERIAL-HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating various applications of Cleveland tramrail systems. Circular entitled "Your Cleaning, Storage, Shipping on One System," illustrating the application of the Cleveland tramrail system to foundry use.

FORGE SHOP EQUIPMENT. Erie Foundry Co., Erie, Pa. Bulletin 220, describing in detail the features of Erie single-frame forging hammers of both the standard and self-contained types. The bulletin also contains engineering data on capacity, power requirements, etc., and includes instructions for installation and operation, as well as for resetting valves.

SEPARATING AND PURIFYING MACHINERY. Sharples Separator Co., West Chester, Pa. Bulletins illustrating and describing the Sharples super-centrifugal fuel oil purifier and reclaimer and the Sharples super-centrifugal oil purifier and reclaimer. Leaflet descriptive of the Sharples super-centrifugal machine for industrial separation and clarification.

POWER TRANSMISSION EQUIPMENT. Diamond Chain & Mfg. Co., 409 Kentucky Ave., Indianapolis, Ind. Wall chart, giving information for selecting the proper chain for any application—size, pitch, weight, tensile strength, speed, rated horsepower, and load in pounds of Diamond chain, and corresponding information on sprockets to fit various sizes of chain.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Folder 5192, illustrating and describing various applications of truck-type switchboards. Booklet C-1861, treating of outdoor switchhouses. Circular 31C66, on Westinghouse Type H indoor bus-bar supports. Special Publication 1857, dealing with the electrification of the Great Northern Railway.

SANDBLAST AND DUST-COLLECTING EQUIPMENT. Pangborn Corporation, Hagerstown, Md. Folder announcing the twenty-fifth anniversary of the founding of the company. The circular points out the various fields in which Pangborn sandblasts and dust-collecting equipment are applicable, and shows illustrations of several plants in which this equipment has been installed.

ROLLER CHAIN. Link-Belt Co., 501 N. Holmes Ave., Indianapolis, Ind. Roller chain data book No. 1257, which comprises a manual for selecting and applying chain. This 96-page book illustrates the construction of the chains and wheels and shows many applications of Link-Belt roller chain on light- and heavy-duty industrial drives and on all types of machinery, tractors, trucks, etc.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins 847A, 974B, 1105A, 1130, 1345 and 1172, illustrating and describing, respectively, induction differential relays, oil circuit-breakers, undervoltage devices for oil circuit-breakers, direct-current turbine-generator sets, mechanical-drive turbines, and super synchronous motors for large grinding and pulverizing mills.

SPRINGS. Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill. Spring chart for wall use, covering a complete line of flat-round and square springs, including eighty-three sizes of flat-round and thirty-five sizes of square springs. The tables give complete data as to size of hole in which spring will work readily, inside diameter of spring, size of wire, loading, maximum compression, etc.

PLATING AND POLISHING EQUIPMENT. Hanson-Van Winkle-Munning Co., Matawan, N. J. General catalogue 109, of polishing and plating equipment and supplies, including buffing and polishing wheels, polishing belts, scratch brushes, anodes, wire-dipping baskets, cleaners, motor-generator sets for electroplating, plating barrels, conveyors, tanks, polishing and buffing lathes, tumbling barrels, etc.

DIE-CASTINGS. Superior Die Casting Co., 875 E. 70th St., Cleveland, Ohio. Booklet entitled "Better Methods—Better Die Castings," illustrating various typical examples of die-castings made from "SuperCast" alloys. The examples show the wide range of shapes and sizes that can be successfully produced by this process. Circular containing a reprint of an article from MACHINERY on a zinc-base alloy known as "SuperCast Alloy No. 2."

INDICATING AND CONTROLLING INSTRUMENTS. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Booklet entitled, "More Blast Furnace Output Per Pound of Coke," showing how proper instrument equipment, correctly installed and operated, enables the blast furnace operator to make more and better iron in less time. The booklet tells what instruments are required for efficient operation of the blast furnace, washer, stoves, blowers, and power plant.

GEAR GENERATORS. Farrel-Birmingham Co., Inc., 344 Vulcan St., Buffalo, N. Y. Catalogue of Sykes gear generators, containing an outline of the development of this type of machine, a description of the Sykes continuous-tooth herringbone gear, and a discussion of the principle of generating employed. Information is also given on preparing the machine for generating, setting up, operation, etc. The last part of the book contains illustrations and data pertaining to the various sizes.

MARKING DEVICES. Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn. Catalogue 29, entitled "Better Marking at Lower Cost." The catalogue is divided into two parts, the first of which gives a brief outline of the history and facilities of the company. The second contains a description and illustrations of the various "Noblewest" marking devices, including hand- and power-operated marking machines, graduating machines, marking presses, numbering heads, die holders and dies, stamps, etc.

GEAR-CUTTING MACHINES. Newark Gear Cutting Machine Co., 69 Prospect St., Newark, N. J. Circulars illustrating and describing the company's line of gear-cutting machines. The circulars cover the No. 0 gear-cutter sharpening machine; the No. 3 gear-hobbing machine called the "Spirit of Production"; the No. 5 gear-hobbing machine for helical gears, worm-wheels, and spur gears; and the Nos. 5, 7, and 55 spur gear cutters. These machines are all illustrated and described in detail, and complete specifications are included.

TAPS AND DIES. John Bath & Co., 18 Grafton St., Worcester, Mass. Catalogue 12 or Ground-Thread Handbook, containing information on tapping and thread-gaging practice, as well as specifications covering Bath ground-thread taps, Acme and square-thread taps, thread-rolling dies, ground-thread chasers, internal micrometers, master reference rings, and ground-thread gages. One section of the book, entitled "Tapping Helps," gives valuable suggestions relating to the sharpening of ground taps, lubrication, speed of tapping, etc. The last section contains tables and reference data covering dimensions of standard taps, tolerances for taps, types of screw threads, thread tolerances, tap drill sizes, etc.

WELDING EQUIPMENT. Linde Air Products Co., 30 E. 42nd St., New York City. Booklet entitled, "Fabrication of Welded Piping Designs," intended to enable the executive, welder foreman, and welder to apply successfully the fundamental designs described in a former booklet entitled, "Design Standards for Oxwelded Steel and Wrought-iron Piping." The booklet describes in detail the correct procedure to be followed in making welded line joints and fittings, and methods of laying out templets for pipe fittings. Tables for estimating costs are included. Booklet on the subject of airplane fuselage welding, containing instructions for welding operators engaged in airplane manufacture. The second part of the book describes the welding of Duralumin. Twenty-four page booklet containing information on the installation of oxy-acetylene welded piping for industrial uses and also for the heating of domestic and industrial buildings.